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VOLUME III

BEST IN THE LONG RUN

WHAT?

GOODRICH PNEUMATIC TIRES

EMBRACING THE
HISTORY OF PNEUMATIC TIRE DEVELOPMENT FOR
BICYCLE, AUTOMOBILE AND MOTORCYCLE
USES—AND THE STORY OF GOODRICH
PNEUMATIC TIRES, INCLUDING
THEIR MANUFACTURE

WRITTEN IN
THE SALES TRAINING DEPARTMENT OF
THE B. F. GOODRICH RUBBER COMPANY
AKRON, OHIO

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Preface

FOR the benefit of those who have never heretofore appreciated fully the importance of the pneumatic tire in its relation to achievement in road vehicle construction, or inquired into the mysteries of its manufacture, we wish to preface what is to follow with the astounding statement that neither the bicycle, automobile, nor the motorcycle would have ever reached success without this adaptable link in the power transmission systems of these conveyances. This assertion is exemplified by the virtual failure of all three, until the exponents of each in turn saw this truth and recognized it.

Pneumatic tire development has accordingly been slow, extending over nearly a century, beginning with 1845. In truth, it was not until recently that the general public came to recognize compressed air as the one cushioning medium for which there is, and likely can be no substitute. It is now universally conceded in engineering circles that the air inflated tire offers for these types of vehicles the only medium through which power can be successfully applied to the inequalities of road surfaces.

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THE BICYCLE TIRE

Introduction

EVIDENCE is not lacking that the bicycle, so popular as a means of locomotion before the advent of the automobile, has gradually come into vogue again, and has emerged completely from the temporary obscurity into which it was thrown by the rapid rise of the power-driven vehicle. But as we have it today, this two-wheeled vehicle, for everyone save the younger generation, is strictly a utilitarian machine, and this fact, in a large measure, tends to obscure the vast extent to which it is used.

The history of the industrial development of this important member in the world's transportation system from 1816 to the present day, of how and why the bicycle came to its present wide scope of usefulness, the part played by the pneumatic tire and its history is a tale filled with interesting episodes, and one around which a wealth of human interest has centered.

The abbreviated story as presented here, although familiar in some of its aspects to many, we believe will not only be found interesting but instructive to those who are desirous of familiarizing themselves in a general way with the rubber business. In so far as we are aware, there is no other publication which treats the subject of bicycle tire manufacturing in its entirety in such a manner as to give the reader a quick, yet comprehensive knowledge of the business especially so, be he one previously unacquainted with rubber manufacturing. In its pages we have set forth those things which we consider to be pertinent from the standpoint of a general education on the manufacture of bicycle tires, but in no respect do we wish it to be considered as a technical text.

CHAPTER ONE

A Brief History of the Bicycle and Its Tire

PROBABLE ORIGIN OF THE BICYCLE. The exact date of the origin of the bicycle is somewhat uncertain; although most authorities seem to agree that this useful vehicle was originated at Mannheim, Germany, about 1816 or 1817, long before the invention of either the solid or pneumatic tire and that one Drais by name was the genius who first conceived the possibility of "walking sitting down." It is further told that the ruler of the grand-duchy of Baden, on viewing Drais' model was so pleased with the novelty of the idea that he made the inventor a gift of a valuable diamond ring. Drais' funny contraption, called the "Dandy Horse" or "Draisiene," consisted merely of two wooden wheels, one behind the other, connected by a wooden framework upon which there was placed a saddle. The front wheel was connected to the frame by a swivel and equipped with a steering handle which had somewhat the appearance of a cat-boat tiller.

This "Walking Bicycle" which made its first appearance on the streets of Paris, creating a furore among the inhabitants, was operated by the cyclist either running astride or alongside until sufficient momentum was attained to balance it. He would then jump into the saddle and coast until the machine came to a stop. As can be imagined, the rider, by a continued repetition of this performance, could get considerable exercise in the course of an hour or so and was usually ready to quit before he had gone any great distance.

Although the novelty of this sport soon wore off, and its popularity died down, the conception of the bicycle was firmly established and mechanics of different nations from then on were constantly working towards its perfection. There were naturally many queer inventions and ideas incorporated in the early patents because many men were striving independently toward the same ends and a multiplicity of designs resulted.

Evolution. After this first craze died down, it was, strange to say, thirty years before bicycles again came to popular attention. The second visitation of the cycling fever was started by a new invention in Paris, during 1866, and quickly spread to England and the United States. Although this new machine was a great improvement over the first, being propelled by cranks and pedals attached to the hub of the front wheel, it was aptly dubbed the "Bone Shaker," and again the public found cycling too strenuous.

The Franco-Prussian War, (1870-1871) resulted in the transfer of bicycling activities to England and America for a time and about 1876 the "Ordinary" or "High Wheel" type was brought out, equipped with solid rubber tires. Cycling now became very popular. So much so in fact that racing, tours and riding exhibitions were classed among the regular sports.

It is a law, that complete success will come only to those things which have an appeal to the majority, and thus it was with the bicycle. Although solid and cushion tires made a wonderful improvement in its comfort and speed, this vehicle was still a hard running and riding affair unless one met with perfectly smooth, hard roads and was satisfied with a moderate pace. This condition made the early bicycle a plaything for the few enthusiasts and riders who could find time to pick out the smooth roads. Naturally, it was foredoomed to a third failure and only one thing saved it from such. This was the pneumatic tire, which when adopted as regular equipment on the "Safety" model bicycle, made it popular with the masses as a pleasure and utility vehicle. This machine, first seen in 1885, came out in quantities about 1890, equipped with pneumatics, and was the direct fore-runner of the modern diamond frame standard bicycle, being used today, in ever-increasing numbers.

At that time there were, however, still a great many objections to the Bicycle from the standpoint of the American public. The mechanical features were not perfected nor standardized. Tire troubles and other annoyances were frequent,—good roads were almost unknown. Suburban trolley cars were becoming more numerous and more popular, and, as with all fads, enthusiasm gradually died away. Thus by a combination of circumstances the bicycle industry suffered a relapse for ten years.

However, this useful article has *come back and to stay*, and today it is recognized as the simplest, most economical means of transportation, either for utility or recreation, known to man. Following its last decline as a popular pleasure vehicle the census reports of the last seven years show a continuous increase in Bicycle production. From 3,000,000 to 3,500,000 are in service today, using yearly about 3,500,000 tires, and the present average yearly production is about 500,000 machines.

Those concerns which are manufacturing bicycles today are, in most cases, old companies whose origin dates back to the first days of the "Safety." For a time the tendency seemed to be towards a cheap machine but the present trend, it gives us pleasure to relate, is toward a better article, and these same conditions naturally follow in the manufacture of its tire equipment.

Early Tire Inventions and Experiments.

When the "Dandy Horse" first made its appearance, over one hundred years ago, the use of rubber for bicycle tires had not been thought of and in all of the literature on the subject, no mention is made of rubber tires for a two wheel vehicle until about 1876 when the Ordinary or "High Wheel" velocipede made its appearance equipped with the solid rubber type. McIntosh, in 1884, introduced his "cushion type," a solid tire with a sponge rubber or hollow center, and though attaining some popularity this tire was rather unsatisfactory on account of the leg power required to push it over surface inequalities.

To many it is a very peculiar circumstance that although as early as 1845 a carriage tire patent had been issued by the English government to Robert Wm. Thompson, providing for an "hollow elastic belt, constructed of India rubber, the same to be inflated with air, thus forming a resilient cushion between the wheel and the ground," bicycle adherents apparently seemed not to have heard of this invention or at least not to have grasped its significance. For although in those days solid and cushion rubber tires were considered luxurious and beyond improvement, there always existed the desire for more speed which, with the solid rubber tire, was practically unattainable.

Rubber being an incompressible substance, it was noted that if depressed, an equal volume would be displaced and in the instance of the solid tire, the sides would bulge, forming a small lump on either side at the point where the tire came in contact with the ground; effecting a hill, as it were, in front of this point, over which the wheel was constantly climbing. Thus, the limitations of the solid tire were long recognized but not until forty-three years later (1888) when a Scotchman, James Boyd Dunlop, a veterinary in Belfast, Ireland, first made practical use of the pneumatic principle in the construction of a bicycle tire, there was no practical solution of the problem offered. Whether or not Thompson's invention came too early in the history of rubber manufacturing for its practicability to be recognized, we are unable to prove, but such, probably, was the case for it evidently was soon afterward forgotten.

Dunlop's Invention. Dunlop, realizing the limitations of solid and cushion tires, on being asked by his small son to make it possible for him to beat his companions on the tricycle, first conceived the idea of a spring wheel. Failing in his attempt to design a practical resilient wheel it occurred to him that air offered the solution to the problem, providing some suitable container could be worked out. With this idea in mind, Dunlop, who concluded that air was a perfectly elastic medium, constructed an annular tube from a sheet of rubber 1/32″ thick. After stretching this rubber tube over a channel rim on the wheel, a strip of linen tape was wound helically around it; which makeshift held the tube in place and at the same time protected it from abrasion. This crude tire was then inflated through a section of small tubing which was afterward tied with a string to hold the air in, much in the same manner as was the stem of the old fashioned football bladder.

The fact that Dunlop used air as a cushioning medium is not strange, but, as he afterwards said, "the peculiar part of it is that this means has not been successfully employed before, since footballs, and other air inflated articles made of rubber have been in common use for some time." While not a few laughed at the idea of the pneumatic tire, there were many who quickly realized the significance of the invention.

John Boyd Dunlop surely deserved much praise and credit for having revived a principle that might not have been thought of for many years, for it was he whose originality of thought and genius opened a way for the development of one of the greatest inventions in the history of transportation. Subsequent events, however, have shown that he has received a great deal of credit for the development of this idea to which he was not entitled. In other words it has been pointed out that nothing was covered by his invention that had not been anticipated in Thompson's patents of 1845 and therefore, we are inclined to give later developments of the idea the credit for the success of the Dunlop Company and its tire.

The merits of the pneumatic tire were soon recognized; but the problem remained of devising some means of attachment to the rim that could be relied upon to make cycling safe, and to Charles Welsh belongs the honor of making this first improvement upon the Dunlop invention. His ideas, patented in 1890, and sold to the Dunlop Company provided for the addition of a thick casing of compounded rubber and cotton fabric, through the edges of which ran wire retaining rings, thus forming inextensible beads which were fitted into grooves on a specially designed rim and this same principle is still employed in the construction of straight bead automobile tires. This is one of the inventions, previously spoken of that made the success of the Dunlop Company possible since by its adoption they were able to protect themselves from infringements.

The Bartlett Patent. It soon became doubly apparent that the pneumatic tire had come to stay, and many attempts were made to design others which would not infringe upon the existing patents. One of the most notable successes in this line of endeavor was that of an American, William Bartlett, who in 1890, patented in England, his invention of the "Clincher" subsequently selling it for $1,000,000.00 to the North British Rubber Company, a concern founded by Americans and managed by himself.

Thompson B. Jeffery secured the American patents for the application of this new principle to bicycle tire construction, and the tires were first made experimentally in America during 1891, by The B. F. Goodrich Company, for Gormully and Jeffery, bicycle manufacturers of Chicago, Illinois, to whom the patent had been assigned. Thus we have the beginning of the double tube clincher tire, developed in England and America along similar lines except that the American product was made in two styles, namely, Single and Double clinch, whereas, in England, they made only the Single clinch. Although the patent rights for this clincher type of tire were clearly recognized in both England and the United States, they were not sustained by the courts in France, which fact, no doubt, accounts for the successful exploitation of the clincher by the Michelin and others in France and Germany, and its great popularity in those countries.

The Tillinghast Patent. The tire invention which proved to be the most fruitful and accordingly most important in the history of the American bicycle industry was that of the "Single Tube" or, as it was termed, the "hose pipe" tire, invented and patented by Pardon W. Tillinghast of Providence, Rhode Island, early in the year 1893. Previous to this time, all pneumatic tires had consisted of a separate interior tube and exterior casing, and Tillinghast's idea was the entirely new one of having the inner tube of rubber and the outer casing of fabric and compounded stock built up and cured together as an integral, thereby, as he thought, eliminating tire trouble which was supposed to result from the chafing of the outer casing on the tube of the Jeffery type. We are told, however, that the principal advantage of the single tube was the comparative greater economy with which it could be manufactured, and that from this standpoint it met with almost instant approval. The Tillinghast patent was purchased by a Mr. Gray and the tires were first manufactured by the Hartford Rubber Works of which he was the president, and were accordingly, for this reason, for a time known as Hartford Single Tube tires.

Although exploited in England and on the Continent, making many friends, the Single Tube tire never became universally popular in Europe and the Dunlop and Bartlett patents continued to dominate the market there, but in America it was met, as mentioned before, with almost instant approval from the public because of its comparative cheapness. Subsequently, however, the

Tillinghast tire, on account of the difficulty encountered in making repairs, lost favor with the American rider and was relegated to the category of experimental failures for the time being. This was prior to the advent of leak sealing fluids and quick repair outfits which later came into such general use and the fact that punctures could not be conveniently and quickly repaired overbalanced the advantage of economy in manufacture. Hence when the tire presented itself which offered relief, or, in other words, was less difficult to repair, it was quickly adopted in place of the Single Tube. The Single Tube, however, as we shall point out later on in this chapter, "came back" and came back strong, being today the most important type upon the markets from a quantity standpoint.

The Morgan & Wright Tire. Two years after the Tillinghast invention, i. e., in 1895, a tire entirely different in construction from anything previously seen, came upon the market. This tire resulted from an invention of Fred W. Morgan of Chicago, and was the one which afterwards came to be known as the Morgan & Wright. It was at first considered a "hybrid" resembling somewhat the single tube and yet being a double tube, its resilience being furnished by a "butt-end" inner tube inserted through a slit about five inches long on the inner periphery of the casing, the slit being afterwards laced up similar to the manner in which the football bladder is held within its pigskin cover. The butt-end tube was, of course, the feature of this tire in that it permitted a "hose pipe" construction, resulting in a double tube tire without beads and one which was, therefore, easier and cheaper to manufacture than the G. & J.

When it came to the matter of repairs, the Morgan & Wright was, if anything, easier to manipulate than the double tube which had been previously used, and we may therefore say, in all truth, that on account of the ease with which roadside repairs could be made, and the fact that the Morgan & Wright was nearly as cheap to manufacture as the single tube, there accrued for this peculiar type of construction, the sobriquet, "last word in bicycle tires." At any rate, it had a phenomenal run and for a time came very near supplanting all others in the regard of the cycling public.

Like the G. & J., the M. & W. was first manufactured by The B. F. Goodrich Company, we having secured the first business from the owners of the patent, Morgan & Wright of Chicago. Subsequently, during the height of popularity reached by this type, we secured a license to manufacture it under our own name and for several years thereafter enjoyed a considerable volume of business in this item. Its use has, however, all but died out and, as we will point out later in this chapter, the Morgan & Wright has given way before the single tube.

The Palmer Patents. During the early days of the bicycle "boom" literally hundreds of different types of bicycle tires were designed and patented, as a cursory reference to the patent files will prove. Some of these were freakish and entirely impractical; though others were of sufficient merit to attract general public attention. However, being no improvement on the primary tire types in the manner of their application to the wheel, their wearing and shock absorbing qualities, these numerous patents were, with few exceptions, soon discarded as useless. The one exception which above others resulted in a practical benefit was John F. Palmer's invention in 1892, of a special fabric for single tube tires. This was a decided improvement, in many respects, over any other idea and for this reason deserved and received special consideration. The American rights to these patents were purchased outright by The Goodrich Company, at the very start (1893), and until their expiration (1909), we were the sole manufacturers in America of bicycle tires made after the Palmer idea. Being the sole makers for so long has naturally given us a tremendous lead in this field. The advantages of this tire will be explained in a later chapter.

Reason Why of Popularity. The question naturally arises as to why the single tube bicycle tire gained ascendency in America, the Dunlop wired-on double tube in England, and the clincher double tube in France and Germany. Briefly, the answer is that local conditions were largely responsible. In England, the popularity of the Dunlop was partly due to the powerful influence exerted by the Dunlop Company in favor of their product and partly due to the prevalence there of hedge-thorns along the roadside which made single tube tires impractical without the quick repair materials later developed in America. Why the Dunlop wired-on type never gained a foothold in America, was, no doubt, due to the advantages so early presented by the G. & J. Clincher. In France, where there were no hedge-thorns, the failure of the single tube tire has been attributed to the Frenchman's distaste for roadside repair work, although it is more logical to assume that, had the Europeans had access to repair shops and to the quick repairing fluids later developed in the United

States, the history of the single tube in Europe might have been different.

While the G. & J. and Morgan & Wright tires were both well liked and used extensively, the latter for a time dominating the field almost to the exclusion of all others, the Tillinghast single tube eventually became the predominating tire. The introduction of "Jiffy" and other quick repair materials and the opening of repair shops all over the country doubtless has been responsible in a large measure for this success, but the fact that the single tube came back to a position of dominance was, without doubt, due to its lower manufacturing cost. In other words the fact that it could be manufactured considerably cheaper and therefore sold for less than the G. & J. or Morgan & Wright, coupled with the discovery of methods for its practical repairing, we may say, brought the single tube tire to the leading position which it has ever since occupied.

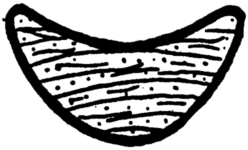
CHAPTER TWO

Bicycle Rims

REASONS FOR THE THREE ULTIMATE RIM TYPES. We have mentioned that during the early stages of the "Safety" bicycle development, there were many different styles of pneumatic tires which condition was caused largely by the desire of each bicycle manufacturer to have something distinctive in the way of tire equipment. Naturally, this desire led also, to a multiplicity of rim types since each tire was designed so as not to infringe upon the then existing patents. In some cases, bicycle manufacturers actually made tires in factories of their own. However, they soon found that tire manufacturing was quite another business and divorced themselves from it entirely. The rubber companies who assumed the tire manufacturing business soon eliminated the freakish and impractical tire styles and this resulted in the adoption of the then four leading types as standards and the practical standardization of rims.

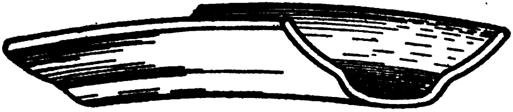
While four types of tires came into general use it became necessary to adopt only three types of rims, since the Single Tube and Morgan & Wright would both fit the crescent rim, and therefore we have as standard equipment today, Crescent rims for single tube and M. & W. tires, Clincher rims for single and double clinch tires, and Dunlop rims for Dunlop wired-on tires. While a crescent style rim or channel had been in use for cushion solid tires prior to the advent of pneumatics, Dunlop rims naturally were the first in the field for pneumatics. Clincher rims followed closely, being first used by Gormully & Jeffery of Chicago, Illinois, on the Rambler bicycle and the crescent rim came soon after, being first adopted, we are told, as equipment for the Hartford Single tube tire by the Pope Bicycle Company of Hartford, Conn.

There have been modifications of all types presented to the trade from time to time, and doubtless there will be others in the future, but a study of those described in this chapter will enable us to grasp the rim situation thoroughly enough for all general purposes.



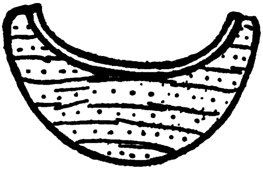
CRESCENT WOOD RIM

The Crescent Rim. The rim most commonly used in the United States today is the Crescent for single tube tires. In design, it is what the name implies—a crescent-shaped felloe to which the tire is fastened with a special cement. Three outstanding styles of this type have been made and widely used; viz., *all steel* at first, then *all wood* and later, *combination wood steel lined*. At present, the preference seems to be for the *all-wood*, since it is lighter, cheaper to construct, more resilient than the others and holds the cement better than a steel surface. Furthermore, the upturned edges of any steel rim may sometimes become bent,



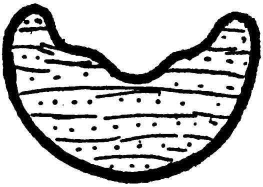
STEEL CRESCENT RIM

resulting in rim cutting and the consequent rapid destruction of the tire and this reason alone is cited by some as sufficient to prevent the all-steel rim from ever becoming popular with the cycling public.



METAL-LINED CRESCENT WOOD RIM

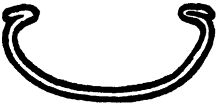
Naturally, the main objection to the *all-wood* crescent rim is its comparative lack of strength and to obviate this difficulty, wood crescent rims are sometimes lined with steel. Even this plan has not worked to entire satisfaction and the avowed reason for the failure of this steel-lined style to become popular is because rim cement will not adhere so well to the metal surface and the user very much dislikes to be continually repairing injuries occasioned by the tire creeping. Thus, because the disadvantages attending the use of the *all-steel*, and the *steel-lined wood rims* are greater than when wood rims are used, the all-wood crescent rim remains supreme.



DUNLOP RIM

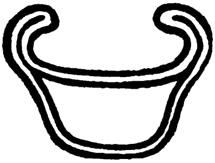
The Dunlop Rim. Originally only steel, but later both steel and wood have been used in the construction of the rim made to accommodate the Dunlop tire which in design, differs from the crescent type principally in that the convex surface is hollowed out to a greater depth. This rim, also is provided with two circumferential grooves, one on either side which engage the retaining wires in the beads of the Dunlop tire. Dunlop rims, naturally, have never been used to any extent in the United States.

Clincher Rims. Clincher rims are nothing more than channel-shaped felloes, with their flanges incurved to form hooks which are designed to engage and hold the beads of the tire. These were first made from steel in the single clinch style, and later in the double clinch, distinguishable by an additional groove in the seat of the rim designed to engage the secondary bead. It was once considered necessary for the proper seating of the tire to the rim to provide this double bead arrangement, but why this type has persisted in the light of more authentic data has remained unexplained, unless that, having started, it became more or less of a fad among those concerns who were advertising and pushing it. Clincher rims, however, since their adoption by Gormully & Jeffery in 1892 have been used by many other bicycle manufacturers in the United States and by a few abroad. Originally, as previously mentioned, they were made from steel and in the single clinch style only. Later, they came to be made from different materials and in a variety of styles, viz., *Plain Steel, Hollow Steel, Metal-lined Wooden,* and *All Wood.*



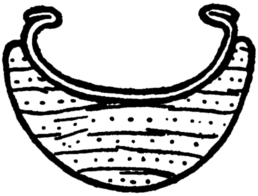
PLAIN STEEL SINGLE CLINCH RIM

The one-piece single clinch steel rim was the natural outgrowth of the original type equipped with solid cushion tires which had preceded it on the bicycle and although Jeffery had mentioned in his patent that the flanges might either turn outward or inward, the general practice, as we know it, of turning them inward was followed as the more efficient.



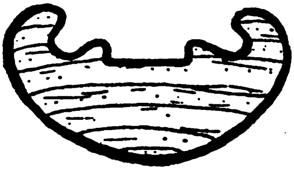
HOLLOW STEEL RIM

In order to get proper proportions and strength in the one-piece single clinch steel rim, it was necessary to design it somewhat shallow, and thus some difficulty was experienced in a proper seating of the tire beads. To overcome this objection a hollow steel rim was designed, being made in both single and double clinch styles. This rim was, in truth, of double construction, the spoke heads being located in the hollow space between the two sections. It was, however, later found that considerable time was lost in assembling the wheels owing to the difficulty in attaching the spoke heads, and the rim was therefore discarded as impractical.



METAL-LINED
WOOD RIM

The rim sometimes known as the *Metal Reinforced Clincher Rim* was later adopted for single clinch tires and for a time it seemed to offer a practical solution of the rim problem since it was light, resilient, strong, and also had a slightly greater depth than the original style, thus giving the beads of the tire more room in which to adjust themselves. Except, however, for single clinch tires, this style never gained the popularity expected of it and few are in use today.



G. & J. RIM

Although clincher bicycle rims have been made from different materials and in a variety of styles, the all-wood variety, in the double clinch type has never been improved upon, and is today more in evidence than ever. The reasons cited by authorities for the continued popularity of this rim are its cheapness, its lightness, its greater resilience, and its freedom from bending at the edge as a steel rim may sometimes do with resultant rim-cutting and rapid destruction of the tire.

Interchangeable Features. Very frequently, the question is asked as to the interchangeability of bicycle tires between the various types of rims. In order that there may be no doubts remaining as to what can or cannot be done in this respect, we will here explain that Dunlop rims will accommodate only Dunlop type tires; Crescent rims will accommodate all single tube tires and the Morgan & Wright type as well; and Clincher rims will accommodate none but clincher tires in the manner hereinafter described. The single clinch rim will accommodate both single and double clincher tires and either can here be used, but a double clinch rim will accommodate none but a double clinch tire and, therefore, caution should be observed in dealing with the clincher propositions and never should single clinch tires be sold as equipment for double clinch rims.

In addition to the interchangeable feature, the chief points to remember about rims are that, inasmuch as single tube tires are now the most popular, *Crescent* type rims are more in general use than the *Clincher*, also, that the latter variety is more in evidence in the West and South where the roads are not so good, punctures more frequent and repair shops few. In this type the all-wood double clinch and the *metal lined wood* single clinch are the most popular. Dunlop rims will not be met with in the United States since very few are in use.

CHAPTER THREE

Bicycle Tire Construction

PREPARATION OF MATERIALS. It may be said that the materials used in the manufacture of bicycle tires divide roughly into two groups:—First, rubber impregnated fabrics, usually cotton, known as "frictioned" and "coated" fabric, is used to give the tire its shape and strength. Second, rubber compounds known as "Cover, cushion and tube stocks are used to give the air retaining and road resisting qualities so vital to the success of the pneumatic tire.

Since those steps—known by the factory as "preliminary process"—whereby the raw materials are made ready for further treatment in the various manufacturing departments, have previously been described in our volume "A Wonder Book of Rubber," it would be but a waste of time and space for us to recount here the various steps through which these *bicycle* tire materials pass before being received into the building department for further treatment. Therefore, except to describe certain fabrics and features not common in the preparation of materials for other rubber goods, we will not dwell upon the subject of "preliminary processes" in the pages of this volume.

Fabrics Used. The subject of fabrics as used in the construction of bicycle tires the country over is one of considerable magnitude if covered in detail, since many and various weights and weaves are required to meet the demands of the numerous manufacturers of this product. The range is from a light cotton drill for the cheapest quality tires on up through the simple woven duck (of eight to eleven ounces in weight) to an expensive special woven material known to the trade as "Motorcycle Tire" fabric which term, by the way, is merely a trade designation applied to a peculiar loosely woven flexible fabric built exclusively for bicycle tire purposes and not indicative of true motorcycle tire construction.

Happily, however, for our purposes we need but describe two kinds, viz., a simple woven duck of a single weight, known as "regular" bicycle tire fabric and a special material known as "web" fabric. The former which we have selected with a view to its suitableness as to weight, strength and flexibility for all reasonable service requirements of bicycle tire usage is standard; and the latter, which we fabricate in our own plant to meet the requirements of Palmer tire construction, is special in every particular.

The "regular" fabric is that material which has for years demonstrated its all round suitability for tires of this character and the student of bicycle tire manufacture may rightly assume that our adoption of a single weight in this one weave for bicycle tire construction has been well considered from the standpoint of service and demand, as well as economy in manufacture. That this is a fabric with the most all round qualifications for a tire of small cross section diameter, such as the bicycle tire, has been demonstrated beyond doubt.

In the manufacture of the Palmer or "web" fabric bicycle tire, originally made exclusively by the Goodrich Company, the unique material known as "all warp, no weave" is used. This we fabricate by a process peculiar to its nature, whereby the threads which may be either cotton or linen, are run parallel to each other from spools through a calender together with a thin sheet of rubber. Thus they become imbedded into the gum in such a manner that they are held together without touching each other and yet without the use of cross threads or, as they are commonly termed, "filler threads." The completed "web" fabric, as it is now known, comes from the machine in a continuous strip the width of the calender, which for use is cut on the bias into the desired lengths and split into suitable widths, having the appearance of long ribbons with obliquely trimmed ends.

Compounds. The ingredients that go into the compounding of rubber for bicycle tires should be, as might be surmised, selected with the service demands and the ultimate value of the tire in mind. In general practice, however, stocks are compounded in many colors and qualities, the one selected depending upon the desires of the trade or the ideas of the manufacturer himself. We, on the other hand, in keeping with our practice of producing values by volume production, a plan not possible where a wide range of qualities is offered, have adopted a standardized quality, which can be depended upon to produce a "bang-up," lively, long wearing and attractive product.

Obviously, however, compounds used in the various tire component parts must differ considerably in admixture of ingredients according to their several uses. The inner surface of the tire, for example, does not perform a service equal to or ever comparable to that of the tread and must accordingly differ in make up. Likewise, the friction in the body fabric must differ from the sidewall stock in compounds used and so on throughout the whole construction. And here it is that knowledge of the compounding art plays a great part in producing a balanced, long wearing product at a cost within the reach of the great majority of ultimate consumers. In a word, quality plus value.

Variations in Color Combinations. Although there has been for some time past a general gradual tendency toward standardization in bicycle tire construction the wide diversity of tread patterns and color combinations in treads and side walls which was the rule in the past is even yet, to some extent in vogue. Such a practice, it will be recognized, has nothing in common with efficient shop operation for seldom is there an order for a single pattern and color combination large enough to make a good run; and each change necessitates delay incident to cleaning the machinery for a new batch of stock. So it is, that the disadvantages attending the manufacture of a diversity in color combinations far outweigh any psychological advantages which may accrue to the trade through the continuation of a custom which, as we shall later see, is of doubtful value to any one and surely of no value to the manufacturer or ultimate consumer.

As a rule, where used, these vari-colored stocks are a solid color throughout, although some belong to that category known as "Veneered Treads." This latter construction is of more recent development, following the original colored tread idea and as the term implies, consists of nothing more or less than a thin veneer of colored compound placed and vulcanized over the cover of an ordinary solid white or grey tire. Outside of the fact that this veneer will wear off quickly, leaving a tread with a bad appearance, a tire made this way may give just as good service as though the stock were a colored compound throughout. The difference in cost, however, between this style of construction and the solid color tread is not great enough to warrant its use, even where color variations are the rule.

Once begun there will be no end to the colors and color combinations the manufacturer will be asked to furnish, and a multiplicity of greys, whites, blues, blacks, and reds in solid color and veneer treads will be demanded. This same condition is true of tread patterns, fabric and compound quality and as a result over-head costs pile up until the quality of materials used constitutes the least part of factory cost and the profits of the business become entirely eaten up by specials. With this in mind, it should not require such a tremendous stretch of the imagination for even the novice to come to an understanding of why we have discarded such wasteful methods of manufacture and have established a single color combination for Goodrich, a single color combination for Diamond and a combination of these two for all special brands, and why we will furnish but one quality of carcass and cover stock.

Single Tube Construction. In the manufacture of single tube bicycle tires there are two practical methods in vogue. One is known as the "drum method," the other as the "Mandrel method" and the ordinary single tube tire, i. e., one of woven fabric construction, can be made by either plan with almost equal effectiveness.

Mandrel made or "hose pipe tires" as they are sometimes termed from the resemblance of this plan of construction to that used in building "wrapped duck" hose, are made over cylindrical iron rods or as they are usually termed, "mandrels." Calendered sheets of rubber for the inner tube, intermediate plies of frictioned fabric cut on the bias, and an outside layer of compounded rubber are required, each part being superimposed upon the other and carefully rolled together by means of special hand rollers and tools. This straight tube is then pulled from the mandrel, the ends carefully joined and spliced together by other workers, and thereby an endless pneumatic tire is formed, the component parts of which are afterwards vulcanized into an integral unit. Although it is claimed by some that "Mandrel" made tires are superior to those made by the "Drum" method, such is not the case, and after having given both a thorough try-out in our factory, we are convinced that the latter process is more efficient than the former. Except for the manufacture of the Palmer type, a place where, on account of the nature of the material used, the drum cannot be employed, we never make use of the mandrel in the manufacture of bicycle tires.

The device upon which Drum made bicycle tires are built, is in reality an iron wheel with an unusually wide and smooth steel felloe over which the tire is formed, the work being done by hand. The stocks as they come from the preparing tables are of course, already cut to the proper lengths and widths for the tire size which has been predetermined by order. An arc-shaped mandrel about fifteen inches long and other special tools are used by the workmen to assist in forming these various flat strips of calendered stock and fabric into an endless tube, composed of an inner tube of rubber compound, an intermediate layer or layers of frictioned fabric, and an outer covering of compounded rubber, the joining together of which by this method is accomplished by one mechanic up to the point where the tire is ready for vulcanization. The inner ply of fabric is first placed over the drum and cemented; then upon this is super-imposed the stock for the inner tube which has first been carefully soapstoned on the inner side to keep it from sticking as the tube is formed. Round holes are next punched in opposite edges of this flat piece through which the valve stem is inserted and the edges of what up to this time has been a flat band are carefully brought together over the curved mandrel and joined. A temporary valve is inserted into the stem and the resulting tube slightly inflated.

The second ply of fabric, the side wall, cushion and tread stocks are next applied to this tube in one operation having been previously assembled in their proper order at the stock preparing tables. A flannellet strip which is frequently used on the rim side of the better grade single tube tires is applied as the last operation and the completed construction is then removed from the drum, inspected and mounted on a rim where it is left to shape itself for a short period before curing.

Palmer Construction. Due to the nature of the fabric and the method used in preparing and applying it the Palmer bicycle tire cannot, as has already been mentioned, be constructed over a drum. Here therefore, we must use the mandrel over which a strip of the "web" fabric, previously cut to the proper dimensions, is helically wound from one end of the pole to the other until it completely covers a tube of high grade rubber which has first been placed in position. The opposite edges of this strip of web fabric, are thus brought together, like the coils of a spring, to form a cover for the tube. A second strip of fabric of the same width is superimposed by helically winding in the opposite direction, thus bringing the threads of the two plies at right angles to each other.

From this brief description it should be evident that Palmer tires must consist of an even number of plies alternately wound at right angles, and such is the case; tires of this construction usually consisting of either two or four windings, and around the carcass thus formed, is built a layer of compounded rubber to make the tread and side walls. The "hose-like" tube thus made is then removed from the mandrel and the ends carefully spliced in such a manner as to give an annular, tubular tire, the component parts of which are afterward vulcanized into an integral unit.

In constructing Palmer "web" tires the only equipment necessary when special sizes are desired are the mandrels upon which they are built, and the rims upon which they are cured. This makes the Palmer particularly available for sulky use and for experimental vehicles with odd size wheels requiring tires that cannot be made with regulation drum and mold equipment. By way of illustration, a few sets of sulky tires can be made up in the Palmer type at a comparatively reasonable price, whereas, if we were required to build special drums and molds, the price of a few such tires would be prohibitive and beyond the reach of the user. One peculiar characteristic of this tire, which is due to the method of its construction, is that when inflated it noticeably contracts in diameter but expands in sectional size. This peculiarity is not an objection but rather a point in the tire's favor since the more it is inflated, the tighter it sticks to the rim, while when deflated it readily assumes its normal size.

Clincher Construction. The nature of the clincher tire permits riding under a slightly less rigid inflation than does the single tube, without fear of injury to the fabric, and thus more comfort for the rider is possible. Furthermore, in case of necessity for roadside repairs, the cyclist usually finds the clincher preferable, and thus, in some localities, for long distance or country riding it is the favorite. Because they are not tubular, but open, the entire circumference of their rim periphery clincher bicycle tires must either be constructed and shaped over removable cores, as are automobile tires, or built flat over drums and shaped afterward. Due to their very small cross sectional size, it is not practical to construct them in the former manner and therefore the "Drum" method is utilized but in a slightly different mode from that described in building the single tube tire.

The Drum itself is similar to the one used in the construction of the single tube except that it is heavier and has milled upon the face of the felloe the tread design desired. In the building of this type of tire, the tread stock is first applied to this engraved surface, after which the various plies of frictioned fabric and calendered stock are super-imposed one upon the other, the beads previously built up of strips of fabric are inserted, and the whole carefully rolled into place by means of hand rollers and other tools. After building, this flat circular band of rubber and fabric is wrapped in rags for vulcanization as will be explained in paragraphs to follow.

General Rules of Construction. No matter what process is used, certain practices or general rules hold true in the construction of any variable quality line of bicycle tires. For example, single tube bicycle tires known to the trade as "Road Weight" are constructed of two plies of frictioned body fabric, while a different weight tire known to the trade as "Puncture Proof" is made by the interposition with the main plies of the carcass of two narrow strips of frictioned fabric just under that area covered by the tread. Still another weight is made by the use of one such narrow strip between the main plies of the tire, but, this "one insert puncture proof" construction, as it is known, is of later origin and is considered a sort of hybrid. Although, these three constitute the general rule of construction for woven fabric bicycle tires, there are special cases where more plies and heavier fabrics are used. We, however, consider only one, i. e., "Puncture Proof," to be the ideal and better balanced for all ordinary purposes and therefore use it to the exclusion of all others.

"Tandem Weight" in clincher tires corresponds to "Puncture Proof" in single tubes, having two narrow strips of frictioned fabric placed between the main plies of the tire at the tread. Special constructions are also used in building clincher bicycle tires but for all practical purposes, "Tandem Weight" tires will be found to give the best satisfaction and the greatest value.

Let us mention in conclusion of this section relating to construction, that, regardless of type, i. e., whether "Puncture Proof" or "Road Weight," whether woven fabric or web fabric carcass, three main component parts are always in evidence in the single tube, viz., the carcass, composed of fabric, the covering of compound, comprising the tread and side walls, and the inner tube, all of which are built and vulcanized into an integral unit.

Vulcanization. Vulcanization of single tube tires whether mandrel or drum made, excepting the Palmer, always takes place in molds on steam presses, either hand or hydraulicly operated, pressure being supplied on the inside of the tire by passing steam to the interior through the valve stem. To make a tire with a distinctive tread, a mold is used with the required design milled on the surface of its interior, and into these recesses the tread stock is forced by the pressure exerted where it cures to form the non-skid feature. After the tire is removed from the press a certain amount of steam remains within which condenses and accordingly before the valve parts are fitted into the stem, a vacuum hose is attached to the opening and the water blown out.

In the case of the clincher tire the curing is done on the drum, as previously intimated, in an open steam pot heater. Wet muslin strips are wound over the whole face of the drum and pressure is applied by means of soft wire wound around the tire over the rags. The force of this action serves to push the gum evenly into the cavities of the design milled into the face of the drum, thus creating the non-skid feature. In a few cases clincher tires are given a partial cure by this method and are afterward shaped up by giving them a final cure in molds which makes application to the rim somewhat easier. This extra operation, however, adds to the cost of the product and most dealer purchasers prefer to have their clincher tires come flat rather than pay the extra amount for shaping. Accordingly, except on special request, we cure all clincher tires flat.

Vulcanization of the Palmer tire as previously intimated does not take place in a mold under pressure as in the case of the standard single tube type, but in an open steam heater. Before being placed within the vulcanizer this tire is however mounted upon a rim and slightly inflated, after which it is wound with strips of wet cloth and this accounts for the somewhat rough appearance of the tread in the finished product. Because, of the peculiar construction of the Palmer web, this method is used as an added precaution to prevent the threads of the fabric from becoming disarranged or crossed, as they might if the tire were squeezed into an iron mold.

Some bicycle tires are cured in four minutes, some require forty, therefore, in conclusion, it seems advisable to make some general statement regarding this operation. The amount of pressure applied, degree of heat, nature of compounds, and kind of apparatus used, all effect the duration of the cure and the changing of one step in the process may change the others. Therefore, the only pertinent thing for us to remember about this process in connection with bicycle tires is that in the well organized factory, the laboratories work out and instruct the workmen in the use of the one cure which has proven best suited for the particular tire being made.

Bicycle Inner Tubes. Inner tubes for bicycle tires are made in two styles, viz., endless and butt end. The former type designed for use with the clincher, sometimes termed the G. & J. tube is, as the name implies, annular and tubular in form and its use today is general wherever clincher bicycle tires are in evidence. The butt end type, designed for use with Morgan & Wright tires, differs from the endless type in that the ends, rather than being joined or spliced together, are left free, being closed and reinforced with strong canvas. This arrangement permits the tube to be inserted into the slit of a Morgan & Wright casing or a similar slit on the under side of a worn out or leaky single tube tire, as is often done by repairmen. Altho, there are no territorial limitations in the sale of butt end tubes and they are sold wherever repairmen are in the habit of using them for repairing single tube tires, they are becoming less in evidence every day.

Both styles are constructed by the Goodrich factory on a machine from a long strip or band of calendered stock. As this long uncured ribbon of rubber passes through the mechanism, its edges are brought together, cemented and forced into place, forming a butt edge seam, which as an added precaution against the possibility of the unfinished tube cracking or separating at this point, is reinforced by having placed over it a narrow strip of similar calendered gum. The long tube thus made is cut into proper lengths which are then pulled over mandrels and cured in open steam pot heaters. Those to be made endless are buffed at the ends, cemented and spliced while the ends of those to be made into the butt end type are buffed, cemented, closed and reinforced with cotton duck.

For bicycle inner tubes some manufacturers are strongly advocating a thin stock, others a heavy, and each faction advance arguments supporting their contentions. Although as we believe, thickness as well as the quality of the stock used has a marked effect upon the service rendered by the finished product, the mere fact that one tube is thicker or thinner than another does not prove its greater value or serviceability, for any manufacturer wise to the ways of rubber compounding can build a heavy tube at a much less expense than a thinner one of higher quality could possible be made. Furthermore, by the use of the common tubing or "spewing" machine a tube of high quality gum might be turned out at a low cost which nevertheless would not have the serviceability of one made from high grade calendered stock of the correct thickness which practice as exemplified in our product, we believe to be ideal.

Also, in this field the same as with all factory operations, quantity production governs to a large extent the ultimate price of the article, and even with more careful and expensive method of construction it is possible for us thru quantity production to put upon the market a high grade tube at a "Fair list price."

Valves. The term valve as used in connection with bicycle tire construction refers to the whole device thru which the air pressure within the tire is increased or released, and this includes not only the valve parts proper, i. e., plunger, springs, seat, etc., but to the stem within which these parts are contained as well. As may be imagined bicycle tire valves are of various types and kinds depending upon the type of tire for which they are used. Some are attached in one manner, some in another, some are all metal, while some are rubber and metal. Although, it is not essential that the lay public be acquainted with these things intimately, those connected with the sale of tires should have sufficient knowledge that they may recognize each as they have to deal with them.

For single tube tires (except Palmer) valves are attached by means of a short section of cloth-reinforced rubber tubing on one end of which is built a circular washer or foot. This attachment, somewhat resembling a mushroom with a hollow stalk, is built partially by hand and partially on a tubing machine, being later semi-cured in a cavity mold under hydraulic pressure. During the later vulcanization of the tire this valve part receives its final cure at the same time becoming a part of the tire itself.

Into this short piece of tubing, for the purpose of containing the various valve parts, fits a still shorter metal nipple, one end of which is threaded to take the dust cap. This is not inserted however until after the tire is otherwise complete. This metal nipple is first cemented before being inserted into the rubber stem, but before the cement is thoroughly dry and set, a ferrule is forced by special crimping tools, over the outside of the rubber stem, and thus the rubber portion is protected from injury by the rim and the metal parts are held firmly into place.

Palmer bicycle tires require a different type known as a "shoe" valve, which is all metal except for a thick washer of rubber molded over the shoe at the base of the stem. This valve is not built into the tire at the time of making, but is buttoned into a small hole left for this purpose after the tire is otherwise complete. Here the valve is held in place by a nut, and washer which is screwed down upon the tire from the outside, thus pinching it between the shoe underneath and the washer above.

The endless type of bicycle tire inner tube is also provided with an all metal shoe valve which is likewise buttoned in after the tube has been otherwise completed, and this type is also held in place by a nut and washer screwed down upon the outside of the tube as in the case of the Palmer valve. To prevent this valve from tearing out, a re-inforcement is provided at the point where it enters the tube by increasing the thickness of the stock with a pad.

Goodrich and Diamond butt end inner-tubes are provided with rubber valve stems and Schrader Universal Valves. These rubber stems are constructed somewhat the same as those used on single tube fabric tires and also the same as in the case of the single tube tire valve, they are cured with, and become a part of the tube itself. The metal parts are fitted in after the tube is otherwise complete, and are somewhat similar to but not as large or heavy as the metal parts used in the construction of the single tube valve.

Anti-Leak Fluids. A liquid preparation, the purpose of which is to automatically fill up punctures and stop leaks is sometimes pumped into single tube bicycle tires. But, since many of these preparations are injurious to rubber, they should be used only as a last resort after all ordinary methods of repair have failed. Such liquids can, be recommended for use in *new* tires, sometimes as a precautionary measure in the cheaply constructed variety where spongy porous stock is used, that will not long retain air unless thus fortified, but never can they be recommended for use in tires of better quality. Furthermore when beyond repair by ordinary means, the user will find it more satisfactory to either equip these with inner tubes in the Morgan & Wright way, or to throw them away and purchase new ones.

That it is almost impossible to make ordinary repairs hold after a fluid filler has once been used, unless thoroughly washed out, is positive proof that this rule regarding its use is well founded.

CHAPTER FOUR

Bicycle Tire Brands and Their Significance

BRAND CONFUSION. The most casual observer could not fail to notice, if happening to be where boys on bicycles congregate, the almost endless number of differently branded bicycle tires that travel the streets of almost any community. Likewise, many who have stopped at their local accessory store to make a purchase of some sort, while waiting have probably idly wondered what were the reasons for the hundred and one bicycle tire brands usually displayed on the dealer's racks. In order that we may better grasp the significance of this condition, and why *we*, as well as some others, manufacture bicycle tires of more than one brand, it seems best that this chapter should be prefaced with a résumé of past trade tendencies and present outlook.

We will begin with the early 90's when cycling was gaining in popularity with the general public as a means of entertainment and exercise and when also the jobbing house was just beginning to make itself felt as an important factor in the merchandising world. The manufacturer about that time began to recognize the jobber as a logical medium through which he could supply a greater number of users with less sales effort on his part than otherwise would be required, and the jobber, likewise, being always on the alert to widen his field of activities was not slow in sensing the possibilities for additional profits to be made by the sale of bicycles and immediately began negotiations with the manufacturers. In this move the jobbers were very opportune, for the bicycle manufacturer realizing that the permanence of his device was not assured, and even so, that there were many difficulties to be surmounted in the task of building up business through a large number of dealers, was glad to avail himself of this new channel for the widespread and effective distribution of his product. Since the sale of bicycles naturally involved the sale of tires, jobbing houses were also quick to make arrangements with the manufacturers of tires, who in the early days of the bicycle industry were just as anxious to avail themselves of jobber's selling organization as were the makers of bicycles.

Realizing that by advertising and pushing their own brands, they would be constantly advertising themselves and building up good will among their customers, jobbers demanded that the manufacturer furnish tires made under their own names and trade marks, and thus special or "private" brand bicycle tires came to be established. Being thus well rooted, this special brand business was further encouraged by trade conditions which at one time made it almost impossible for jobbers to deal in manufacturers branded tires. In other words, competing jobbers had nothing to offer where each were dealing in the same manufacturers branded tires, except price; and as a consequence prices were forced to such a level that profits were almost eliminated. On the other hand, selling private brands, the purchase price of which were only known to themselves and the manufacturer, afforded jobbers the opportunity to make sales on other than a competitive price basis.

Distinctive tread design, color combination, and quality gave each something different to offer the trade and this to a certain extent removed the price consideration. These conditions together with the bicycle tire manufacturers lack of selling initiative placed the private brand tire early in unquestioned supremacy.

When we pause to consider these many phases of the history of the bicycle tire business we must surely come to a realization of the chaotic state of affairs which was finally brought about for the tire manufacturer by the increasing multiplicity of brands, qualities, constructions, tread patterns, color combinations, special fabric weaves, etc. It was an appallingly hetrogeneous mixture and the consumer paid dearly in reduced values for all these special features. Thus it continued until finally a point was arrived at, where the tire manufacturer became hard pressed to make a profit, when the abnormal economic conditions brought about by the World War hastened a standardizing all along the line which the tire manufacturer himself must surely, sooner or later, have brought about upon his own initiative.

Those who have read thus far cannot but realize that to have successfully manufactured a line of sufficient range to meet the fluctuating demand thus created, as we did, involved considerably more skill and attention to manufacturing detail, than the average person might imagine. This truth convinces us that the popularity everywhere now accorded Goodrich and Diamond brand bicycle tires is principally due to the fact that our factory men by consistent and methodical attention to every phase of manufacture had succeeded in perfecting methods of construction so far in advance of the old ways that uniformity and quality were brought to their highest known standards in spite of conditions. However, though a high state of perfection had been reached in the realm of multi-brands, the obvious lesson to be drawn from the past is that such multiplicity could not have resulted in anything but confusion and waste, thereby ending eventually, as it did, in decreased rather than increased bicycle tire profits for the manufacturer.

Standardization. There began about 1910 or 1911, a concerted movement on the part of the bicycle and accessory manufacturers to bring about a standardization of bicycle parts, the accomplishment of which purpose naturally resulted in cheaper, yet better bicycles for the consumer, and a largely increased production for the manufacturer. One favorable result of this movement, which above all else, has benefited the tire maker, was the almost immediate demand for a better tire by all classes of purchasers. Following, it became no longer the exception for the bicycle dealer or jobber to sell more high grade tires than cheaper ones, which condition partially prompted the first move toward the standardization of bicycle tire construction.

Our initial step toward this much to be desired goal was taken early in 1916, when we brought out our "White Safety," "*made to fit 28" rims*," but the big movement toward standardization was not, however, started until 1917, at which time we announced to the trade, the discontinuance of all special features, save our Palmer Web tire, and the adoption of one quality and one construction for Goodrich, Diamond, and special brands alike with a very limited number of possible color combinations, in which new line-up the single tube type, by reason of its greater popularity, predominates.

To the lay reader the soundness of this policy of retrenchment may not at once be apparent, and the wisdom of confining the line, and limiting the purchaser's choice may be doubted. On the other hand, it should be plain that a multiplicity of designs and constructions will surely complicate factory problems, and lessen the ultimate value of the product.

Goodrich Brand. Our aim has been for sometime past, is now, and probably always will be, to increase our trademark tire sales, for we feel that the important feature of the bicycle tire business is to establish the name Goodrich with as many tire users as possible. Every dollar spent by us in advertising Goodrich products no matter whether automobile tires, mechanical goods, footwear, or what not, helps to build and strengthen in the public mind, the name "Goodrich," all of which adds to the prestige of our current line-up of trademarked lines which stand out as the highest attainment in bicycle tire construction yet reached.

Our standard "Puncture Proof" tire adopted only after many trials and experiments with all types and styles is designed to meet every reasonable demand from the standpoint of value and service, and although there are hundreds of brands of bicycle tires upon the market, none are better liked or more widely used than Goodrich. This popularity among the users, we feel, is the natural result of the years of untiring and painstaking effort on our part to build into every product, the utmost in value for each dollar invested.

Since, however, it is not the purpose of this volume to acquaint our readers with precise information concerning brands, their names, tread designs, etc., but merely to explain the fundamentals of manufacture and sales of this important product of the Goodrich factory, we will leave the fuller knowledge of these things to be gained from a study of the line itself. Suffice it to relate, however, that all brands sold under the Goodrich trademark, whether single tube or clincher, except Palmer, are made in the same color combination and quality, viz., black tread, white sidewalls, two ply insert, regular fabric construction, more commonly known as "Puncture proof" single tube or "Tandem weight" clincher.

Our cover stock, i. e., sidewall and tread rubber, is as high in quality as has ever been used by us, the quality of the friction has never been excelled in tires of like character and the inner-tube stock in the single tube type, a place where quality counts particularly, has never been surpassed in any manufacturers product. Furthermore, all component parts of our tire are so well balanced, one against the other, that the result is a finished article with a long life even under the most severe service. To improve the adhesion of the single tube tire to the rim, each is fitted with a flannellet strip. Of this line-up of brands, our Safety tread is the leader by reason of its being patterned after our "Safety" tread automobile tire and accordingly dovetailing with our general tire advertising.

There are today many using bicycles for business purposes, who, can well afford the luxury in riding offered by the best. For these, can be recommended THE PALMER as the acme of perfection, since the result of the method of construction used in building this tire is extreme resilience which feature alone has popularized the Palmer "web," as it has been termed, with the cycling public. Because they made cycling easier and faster; they were at the very start received by the rider with open arms and have, to this day, deservedly maintained their popularity.

The mere fact that The B. F. Goodrich Company has been manufacturing this type almost from the time of its invention by John Palmer, in 1892, explains our faith in this style of construction, and should convince the reader of its superiority over any other, for certain kinds of service. The Palmer has no equal as a racing tire and for light city service it is recognized by the discriminating rider as "Tire Ideal." We furnish it under the *Goodrich* trademark only, but in two weights: Road, and Racer.

Diamond Brand. Soon after the Hartford Rubber Company began making single tube bicycle tires under the Tillinghast patents (1893) the Diamond Rubber Company, then a competitive corporation, secured from Mr. Albert Pope, the holder of these patents, a license to manufacture single tube tires and began making them in quantities. This circumstance really marks the beginning of the most widely used type of bicycle tire we have in the United States today. The tremendous volume of popular good will built up for Diamond brand bicycle tires and the well deserved approval with which they have always been received, has merited their continuance by the Goodrich Company since the merging of the two organizations. Without a doubt this demand will exist for some time to come and to ignore it by a discontinuance of this brand would result in the loss of considerable volume of bicycle tire business from those who have always been inclined to favor the Diamond tire. Therefore, we continue to make and market under the Diamond name *Our Standard* Single tube and clincher bicycle tires all of which are fully guaranteed by the Goodrich Company.

The present line-up of Diamond Brands, like Goodrich, represents the highest attainment in bicycle tire construction, consisting of a single quality, and construction, that is designed to meet every reasonable demand from the standpoint of value, and service.

Special Brand. As our readers doubtless have inferred from what has been related in preceding paragraphs of this chapter, the Goodrich Company has been manufacturing special or private brand bicycle tires for manufacturers and jobbers of bicycles from the very inception of the pneumatic tire industry. In fact, the original G. & J. tire was a special brand made by the Goodrich Company for the holders of the clincher patents.

As pioneers, therefore, in the manufacture of private brand bicycle tires, we have, through our long term of experience in this field, gained a knowledge of and complied data concerning their manufacture, which to us proves conclusively that to continue the practice of supplying anything and everything the trade might fancy in the way of construction, color combinations, etc., would surely have resulted, eventually, in either an unwarranted burden upon the buying public or the flattening out of tire quality entirely. We do not wish to infer by this that special brand bicycle tires have become a dead issue altogether, for such is not the truth and doubtless they will continue to play, for sometime to come, an important role in the scheme of bicycle tire manufacture and sale. In fact, we will continue to solicit this character of business as long as there is any to be had but under a much restricted sales program.

In other terminology, we no longer follow the practice of supplying special brand, bicycle tires in a variety of color combinations, qualities and constructions, but have standardized in this, the same as in our own trade marked lines. While we continue to furnish tires to the trade in a variety of standard tread, patterns and occasionally with entirely special non-skid designs, we maintain only one quality and construction, which is the same as furnished in Goodrich or Diamond brands, i. e., Puncture Proof, regular fabric carcass, and are limited to the color combinations supplied regularly in Goodrich and Diamond makes.

After what has been related it hardly seems necessary that we advance arguments in support of this policy, as applied to our special brand out-put, but that we may more quickly reduce our justification to concrete form, the mention of the following advantages of complete standardization may not come amiss.

First of all, since the production of special brand tires under this plan does not in any way or manner affect manufacturing processes until we come to the "cure," where, by simply changing the mold we change the brand, the ultimate consumer receives the benefit in increased values through uninterrupted production. Second; since the tread desired or the brand used is only incidental and does not affect the cost materially except as to the mold itself we are enabled by the standardized plan to deliver the same quality tire to the jobber for approximately one-third less than was possible under the old regime. Third;

deliveries are not the bug-bear that they were in times past since we no longer are obliged to wait for small batches of special compound to season or for the calendering room to run a few yards of this or that fabric; but can anticipate our stock requirements far enough ahead so that no delays need be experienced, a condition not possible when special constructions were the rule, and re-orders accordingly uncertain.

Special Molds. Even though we are prepared to furnish a varied line of tread designs on our special brand output, occasionally there will be a customer who will insist upon having his own private pattern. We are thoroughly equipped to furnish any special molds necessary for this purpose and will do so without extra charge providing we get a bonafide order of sufficient size to warrant our assuming the expenses of making such molds. On the other hand, should the customer agree to stand the cost, we will accept orders for any quantity from twenty-five pairs upward and agree to rebate the cost of the mold in the event he orders out the minimum number of tires under which we will assume such mold expense.

All special mold propositions should, however, first be submitted to the factory for approval before we commit ourselves to any definite action or promise which ruling is absolutely inevitable since in many instances the designs selected by the customer are found to be impractical. By way of illustration, should such a proposed special tread consist of heavy projections formed by a deep pattern cut into the mold, the fabric during the curing process, would follow the tread stock into these cavities and the effect of this action would be to distort the carcass and place upon it a stress or tension that sooner or later becomes aggravated to such a degree as to result in premature destruction of the tire. Furthermore, tires with this defect are very difficult to repair since the plugs used for this purpose do not have an even surface upon which to rest and thus their mission is defeated.

Branding. Inasmuch as the branding of bicycle tires, with the manufacturers or sellers name and trademark, is done by the mold during the curing process, it might seem, on first thought, that we must necessarily equip ourselves with a full complement of molds for each of our special brand customers, even though our own standard tread designs were largely supplied. As a solution to this problem, molds are slotted so that when orders are received for any quantity of tires to be made in any of our standard designs, it merely is necessary for us to fix a matrix of the customer's brand into the slot and fasten it there by machine screws from the outside.

This plan usually enables us to keep our stock of molds in service almost constantly and thus, we are saved the expense that would otherwise accrue should we provide separate molds for each customer. The matrices or blocks which fit the standard molds are usually made up when contracts are secured and are immediately available as orders are received. By this system we can furnish any length brand up to eighteen inches, but should full side branding be desired a complete half mold is made necessary which by all means is to be recommended since it permits the use of larger letters in reproducing trade marks thus greatly enhancing the appearance of the tire.

CHAPTER FIVE

Bicycle Tire Marketing

DISTRIBUTION AND SELLING. Goodrich bicycle tires both trade marked and special branded, are marketed through our branch and depot organizations and are sold to the trade by the regular corps of pneumatic tire representatives. These salesmen, it is true, work under the direct supervision of the branch under whose jurisdiction their territories fall, but their work in the solicitation of bicycle tire business, as may be supposed, is guided by the general policies of the Corporation. In addition to the special plans each branch manager may have for the promotion of sales of this line, the bicycle tire sales director's office at Akron, from time to time, offers special assistance in the form of suggestions, sales helps and campaign outlines, etc.

It is the aim to stock, at all branches and depots, a complete assortment of such sizes and types of Goodrich trade-marked brands, as are in demand by the trade in the various territories, and in quantities sufficient to meet all reasonable requirements. The benefits to the dealer from having these branch sources of supply located in the more important distributing centers of the country, will be apparent, for this arrangement will save delays and often heavy express charges incident to hurry up factory deliveries from a long distance.

Diamond bicycle tires, both trade marked and special branded, are marketed by a corps of sales representatives known as the "Diamond Organization," who solicit only one class of trade, viz., the jobbing house. This organization is not permitted to solicit manufacturers' or dealers' business.

Unlike the Goodrich brand, Diamond bicycle tires are carried in stock only by certain of our branches which are the ones situated centrally in the localities designated as Diamond Control districts. Otherwise, wherever Goodrich Branches carry Diamond brand bicycle tires in stock it is done because of some unusual condition and is contrary to the general practice.

Special brand bicycle tires, whether sold by the Diamond or Goodrich organization, are never carried in stock by the branches, but are shipped from the factory direct to the customers. When we stop to reflect upon how much capital we might have tied up in stocks were we to agree to carry our customer's special brands until called for, to say nothing of the space which would be required for storage and the expense of rehandling and inventorying, the reason for such a ruling will be apparent and we will not need consider the question further.

Channels of Distribution. A jobber, working as he must, in a restricted territory naturally cannot afford to advertise his special brand tires except in a very limited way. On the other hand manufacturers of both Bicycles and Bicycle Tires are advertising their product nationally as never before. This has had the effect of swinging the public favor to known brands of tires, and as a result manufacturers are more and more finding it necessary to send out their Bicycles completely equipped with tires and all the other necessary fittings, where formerly much of this was furnished by the jobber. And, as is readily evident, of very varying quality. It therefore rests with the manufacturer of

Bicycle Tires, who would build up a trade in his own brands, to follow the policy of dealers' solicitation, not relying upon the jobber to sell these brands for him.

This policy need in no way be antagonistic to the jobber from whom a business on special brands is always attractive, for it is a campaign from which he will eventually reap the benefits by the demand which the manufacturer has created.

We have, therefore at present the following channels of distribution for Goodrich trade marked bicycle tires to consider:

Manufacturers of bicycles to a limited extent.
Automobile, motorcycle and bicycle accessory stores.
Vulcanizing shops.
Retail hardware stores.
Country general stores.
Bicycle and motorcycle agencies.
Bicycle and motorcycle repair shops and bicycle jobbers and others.

For the distribution of special brand bicycle tires we have the following channels:

Manufacturers of bicycles to a limited extent.
Wholesale hardware stores.
Wholesale rubber stores.
Wholesale automobile supply houses.
Bicycle jobbers.

THE PNEUMATIC AUTOMOBILE TIRE

Introduction

EVER since the time when man dwelt in caves and fought his natural enemies with stones and clubs he has been seeking better methods of transportation. However, with all his constant need, evolution in this field was surprisingly slow for, although as history relates, the thought of a self-propelled vehicle had been for many years paramount in the minds of man, no marked improvement in road transportation, aside from the bicycle, were made from the time of the Pharaohs down to the last decade of the Nineteenth Century.

While during the latter part of this interim many experiments were conducted with this end in view, with all steps of progress which had brought the mechanism of the self-propelled vehicle to a point of practicability, if not mechanical perfection, and had forced a skeptical public to recognize the automobile as a permanent factor in transportation rather than a lumbering, wheezing and unsightly curiosity, it was, after all, as we shall later see, the pneumatic tire which happily appeared almost coincidentally with the great practical engineering strides that made possible the successful operation of this conveyance as a road vehicle.

It is not, however, our purpose to dwell upon the past at great lengths, nor to acquaint our readers with a great mass of the historical but to provide a help to a better appreciation of how this great tire manufacturing industry has grown up, and to a keener understanding of the present. We have, therefore, been obliged to pass hurriedly over more than two centuries of struggle and development that we may best accomplish our purpose, viz., the instruction of the student in the elements of present day methods of automobile tire manufacture.

In making plainer the necessity to maximum tire mileage of the practice of taking certain precautionary measures involving the use of so-called tire accessories, we have recognized the value of a brief description of such and have, therefore, devoted a short chapter to this subject. Since there are hundreds, one might almost say thousands, of such articles, naturally, only the more important can be discussed, and the reader, consequently, should not expect to get a full knowledge of Goodrich accessories from this book.

CHAPTER SIX

Brief History of the Early Automobile

ORIGIN OF THE AUTOMOBILE. Surprising as it may seem, the automobile antedates the steam locomotive, a workable one having been built and operated fifty years prior to the laying of the first railroad track. To Captain Nicholas Cugnot, a Frenchman, unquestionably belongs the title, Father of the Automobile, he having built three machines (1760-1770) the last of which is still an object of curiosity in the Paris Conservatory of Arts and Trades. Naturally enough, Cugnot's immediate followers in the field of automobile invention—including Oliver Evans of Philadelphia, the first American automobile inventor—worked along the lines previously laid down by him, also attempting to apply the steam engine idea, which had not up to this time in any field resulted in practical application for the production of power. Consequently, nothing bordering on a successful solution of the road vehicle problem was reached; for these early automobiles were imperfect mechanically, noisy, slow and even dangerous.

Early Inventions and the Steam Vehicle. Wm. Henry James (1823), Pecquins (1828), Goldsworthy Gurney (1825) and Walter Hancock (1830) in Europe; Thomas Blanchard (1825), Wm. T. James (1829), J. K. Fisher (1840) and Richard Dudgeon (1857) in America, were other leading pioneer inventors who, up to 1880, also made attempts to perfect the self-propelled steam road vehicle. In 1833 there were about twenty of this type in operation in and about London, and a dozen or more companies had been formed to build and operate such vehicles over specified routes. The industry even supported its own trade publication, and considerable space was devoted in all technical journals to the subject of motor transportation. Although they made some improvements, such as gear transmission, crank shafts, etc., which were later destined to play important parts in automobile history, none achieved anything like success. In fact, so impractical was steam found for this purpose that early inventors were charged with failure, and it was concluded that steam engines, on account of their weight, and their crudeness of machinery, must necessarily run upon tracks, a theory since disapproved. We may add to this thought that many states even legislated against the use of the highways by the so-called "Devil Wagons."

The Internal Combustion Engine. Dr. Joule, a Frenchman, began in 1844 to experiment with a new type of motor, which was to be the fore-runner of the present internal combustion or gasoline engine. Later Dr. Otto began experiments with this same type and made sufficient progress in two years to attract considerable public notice. It was not, however, until 1876 that Dr. Otto had so far perfected his motor that it was considered practical, and even then it was used for stationary power purposes. While a little later this engine was adopted for the propulsion of small boats, it was not thought suitable for motor vehicles, and, although Dr. Otto devoted his attention principally to the perfection of this motor for the purpose of propelling road vehicles, he never patented his model.

Eventually, however, came the internal combustion engine, designed in 1886 by Gottlieb Daimler and first applied by him to a motorcycle. His principle was received with avidity by automobile engineers who believed it to be the true solution of their power problems. While it is true that several engineers refused to be converted and stuck dogmatically to the steam wagon idea, eventually perfecting it as exemplified by the famous Stanhope Steamer that first appeared about 1897, it was, nevertheless, along the lines of the internal combustion idea that the automobile was to emerge from the seeming lethargy of the previous half century and take its place as one of the most important devices ever made by man.

America's Early Automobile Exponents. In 1872, Brayson, one of the American pioneers, secured a patent on a motor which followed very closely the type which Dr. Joule had experimented with, and in 1887, Geo. B. Selden, a New England patent attorney, invented a motor similar to Brayson's soon after applying to the United States government for a patent. This, however, was not granted until 1895. Selden's claims brought about a legal war which lasted for years, involving many of the leading automobile manufacturers of the country. The final decision was, however, adverse to Selden's claims, for the court decided that the modern automobile motor embodied the principles of the original Otto engine. Had Selden adopted the Otto ideas his patent would have been held valid, and thus it will be seen that the choice which Selden made between the Brayson and the Otto engine, back in 1887 has had a very important bearing on the American Automobile Industry.

Duryea, Winton, Haynes, Olds, Ford, and White are a few of the men whose respective contributions are more or less well known to the public. There are also many others, slightly less well known whose work has been of great consequence in the development of the automobile; but we leave the story of their achievements, as well as that of the foregoing, to the motor vehicle historian.

The First American Automobile. The pioneer automobile manufacturers of America developed their first successful vehicles in the early nineties, but since there are so many conflicting records regarding who actually built the first one, it is impossible for us to definitely establish the fact at this time. Although this information is not of vital importance to us, there is an established record stating that the first sale of an American-built gasoline motor car was made by Alexander Winton of the Winton Motor Carriage Company, Cleveland, Ohio, to Robert Allison, a mechanical engineer of Port Carbon, Pa., late in March, 1898.

Since, however, all previous American machines were virtually failures, it can truthfully be said that Charles E. Duryea in 1895 built the first practical gasoline automobile in this country. The vehicle he produced had multiple cylinders, pneumatic tires, electric ignition, spray carburator, throttle control and many other such modern features. This was plainly ahead of the single cylindered, solid tired, belt driven, heavy constructions which were most common previous to that time.

The Evolution of the Automobile. The Duryea Brothers in Springfield, Mass., were building gasoline buggies, and in Kokomo, Ind., Elwood Haynes and the Apperson Brothers were using gasoline engines in cars weighing 1000 pounds. J. B. West of Rochester, N. Y., had constructed a light gasoline vehicle, probably the first to use a six inch rubber tire for rear wheels; while Wm. Steinway, of piano fame, was building cars using the Daimler motor, for which he had acquired the American rights, and in Detroit Henry Ford was experimenting.

However, prior to 1895, A. L. Riker, Colonel Pope, H. P. Maxim, Morris and Salone, in Philadelphia, and the C. E. Wood Co. of Chicago, chose electric power as the most likely to be serviceable, while Geo. E. Whitney, of Boston, and the Stanley Brothers, of Newton, Mass., were turning their attention to steam as the most desirable power for "horseless vehicles." Thus, the electric vehicle was tried out but proved to be slow, heavy and inefficient generally. The steamer had a flashy but brief run, for it was considered to be too difficult of operation for the average person, and also soon lost its popularity. This left the field open to the gasoline vehicle, which by slow stages developed into the efficient machine as represented by almost any of the makes with which we are today familiar.

As every reader is doubtless aware, the electric vehicle eventually triumphed in the particular field where it has been found to excel in usefulness, and the steam automobile is by no means dead and buried; models having recently come upon the market which bid fair to give the gasoline driven vehicle stiff competition. Accordingly, we still have the three kinds of power used motor cars in the operation of which the pioneers started with; all developed to a high degree of mechanical perfection. What the ultimate type will be remains to be seen, but when we compare these earlier types with the present artistic stream-line bodies, made light but strong, it can be said that nearly as much attention has been given to refinements in the appearance of automobiles, as to mechanical construction.

First American Automobile Race. The first real automobile racing event in America, which took place on Thanksgiving Day, 1895, was promoted by H. H. Kohlsaat, then owner of the "Times Herald," Chicago, Ill. As a result of a heavy three-day blizzard, the half dozen starters faced 18 inches of snow which covered the streets and roads over the fifty-four mile course, and the only entrant to finish was Duryea. The following spring, J. B. Walker, of the "Cosmopolitan" magazine, promoted a race which took place on Decoration Day. The run was made from the City Hall, New York, to Irvington-on-the-Hudson, and return to the Ardsley Country Club. Out of twenty-six entrants, among which were a few foreigners, three of the four cars to finish were Duryea's.

Again in November, 1896, in a run from London to Brighton (52 miles) in which the best of foreign machines were entered, a Duryea won in something like an hour driving time ahead of the second car. Clearly, in those days, America led in the automobile field, but, unfortunately, we did not then use the initiative to take advantage of our opportunities. Abroad there continued to be annual events, and their business grew. But in America there was only stagnation for only two men were willing to invest money in this promising industry and encourage its development. American people were amused, but not convinced and considerable further demonstration was necessary. Eventually, however, the success of the automobile abroad being assured, the American public awoke to the fact that "horseless carriages" were here to stay and thus began our period of expansion. It has been pointed out that automobile racing has contributed more than any other form of advertising toward gaining a wide-spread publicity for the automobile which eventually convinced the American public of the worth of this modern convenience.

CHAPTER SEVEN

History of the Automobile Tire

EARLY TIRE INVENTIONS AND EXPERIMENTS. Inasmuch as the bicycle antedates the automobile, and the pneumatic tire being first used by bicycle manufacturers, it naturally follows that the automobile tire is an evolution of the former. Therefore, its early history is the same as that, told in Chapter One of this volume; to which we refer our readers for refreshment of memory since we are now taking up the story of the tire from the date which marks the divergence from bicycle tire practices.

From the standpoint of the tire manufacturer the automobile arrived about 1898, the year in which it became apparent that a stronger pneumatic was necessary if the real function of the automobile was to be realized, viz., greater speed with comfort and safety. This conclusion was arrived at after repeated attempts to perfect various types of solid rubber and cushion tires had failed and it became obvious that compressed air was the quickest and nearest frictionless of any form of elastic cushion and that the quickness of its reaction was increased proportionately as the volume and pressure was increased.

The pneumatic tire in making possible the phenomenal success of the bicycle had demonstrated this truth, and it was but natural, therefore, for automobile adherents to expect this same principle to also solve their similar but more intricate problems. Automobile tire manufacturers of the various countries logically turned their attention to the development of the types of bicycle tires in use and we have in consequence the single tube automobile tire appearing in America, the Dunlop Wired-on type in England, and the Clincher in France and Germany. The Single Tube, however, because of its general all-around impracticability for automobile purposes soon gave way to the others, i. e., the Clincher (developed from its prototype the Single Clincher bicycle tire) and Straight Side (developed from the Dunlop Wired-on) and these two types have predominated.

The first American made pneumatic tires designed especially for automobile use were manufactured about the middle of 1896 at the expense of the Winton Co., of Cleveland, Ohio. Needless to state these were of the Single tube type; size 34 x 4 being used for front wheels and 36 x 4 for the rear. Mr. Alexander Winton knowing of the merits of the small section pneumatic tire, as used on bicycles, for light automobiles, decided when completing one of his first experimental machines, that it should be equipped with specially built tires of this type in place of the steel or solid rubber variety formerly so generally used by automobile experimenters.

To secure tires such as he had in mind was, however, not easy since the largest pneumatic then made was the 1½" bicycle tire. Nevertheless Mr. Winton wanted something special and presented his proposition to Mr. A. J. Wills of The B. F. Goodrich Co., who in turn conveyed it to Mr. B. G. Work, then superintendent of our factory. Mr. Work, it appears was skeptical of the "horseless carriage" ever becoming a commercial success but after considering the matter decided that if the Winton Co. would pay for the molds we would go ahead and see what we could do. Mr. Winton promptly accepted the terms and placed the order upon which we made good, delivering the tires in October. The story is told of how the crowds in Cleveland, which gathering to gaze at Mr. Winton's "Juggernaut," never failed to take gleeful note and make factitious remarks about its enormous tires. These "burlesque" bicycle tires as they were termed, were, however, the beginning of the tremendous automobile tire industry of this continent.

We, having been manufacturing Clincher bicycle tires for several years, logically turned our attention to the development of this type when we later decided to enter the automobile tire field. Although constructed of nineteen plies of light fabric and, indeed, crude in design, ours was the first real Clincher automobile tire built in America and marked the beginning of its development for automobile use.

The first two cross section diameters, i. e., 2½ and 3 inches, in wheel sizes ranging from 28 to 36 inches were manufactured for sale in 1899, but even these, were more or less experimental and the business was not of enough importance to warrant issuing price lists until October 15, 1900. In 1903, we began manufacturing tires of two weights, which were termed "Light" and "Heavy Profile," the latter being made with more plies than the former and intended for use on the rear wheels only. Later in 1903, our tires in larger cross sections began to appear, the price lists including sizes up to 4½ inches, although even yet very few were manufactured, the output in volume being of minor importance to us.

In 1904, however, the business began to assume larger proportions and a complete list showing consumer's, dealer's, and jobber's prices were printed. The "Bailey" type of tread was at this time adopted by us, and tires for the first time also began to appear in the 5″ cross section. In 1906 and 1907 we commenced to manufacture two styles of tread, the smooth and flat, and also it may be well to note here that up to this time the only type of tire in use was the Regular Clincher (Soft Bead). These same styles, i. e., round and flat tread, in both the "Bailey" and the Smooth were offered to the trade.

Beginning with 1907, the Q. D. Clincher (Stiff Bead) tire was brought out and our line then comprised the Regular Clincher and the Q. D. Clincher in both the round and flat contour "Bailey" and Smooth treads, which line, up to 1909, remained unchanged. Beginning with 1910, however, we discontinued the flat tread confining our efforts to the round contour tread which we continued to make in both Regular and Q. D. Clincher types in "Bailey" and Smooth patterns, and this output for the first time, also included the Q. D. Straight Bead tire in addition to those supplied in 1909. At this juncture we also began to feature our "Master Tread," but this pattern was very soon after, discontinued in favor of the "Safety" which has remained in popular demand up to the present day. From the advent of our "Safety" in 1912 no further radical change was made until the latter part of 1915, at which time we announced our "Black Tread Rubber" to the public.

While prior to 1915 tread stock other than white or grey was not considered seriously by leading tire companies, it was indeed laughable to witness the scramble and haste with which some of these same manufacturers followed our lead when we adopted this new compound.

Although space in this volume will not permit the telling of the black tread history, we cannot help but mention, before passing to more important questions, the comedy of reasons advanced by many other makers in their efforts to tell the public what their black treads stood for.

Tread Development. At the beginning of automobile tire history all tires were made with smooth treads. However, it soon became a general belief that the smooth tread did not offer sufficient tractive qualities and was, therefore, adaptable only to the front wheels which merely roll, and consequently tire manufacturers began experimenting with traction designs. At first these "traction treads" were made solely with the idea of increasing the grip of the wheel on the road and so makers molded transverse grooves (Fig. 1) at about two inch intervals around the circumference of the tread, which design relied on its flatness and square edges to prevent side slipping. This, on account of its flat surface, was not entirely successful because of its tendency to separate from the carcass.

Next came the corrugated tread (Fig. 2) in connection with the non slip idea, which was composed of ridges running circumferencially around the crown of a rounded tread. Although this was some improvement over the flat tread idea inasmuch as it eliminated tread separation and was a more effective preventative against side slipping, it did not give as much traction as desired. And it was only natural then for tire designers to turn their attention toward a pattern which would embody the good features of both the "traction" and the "ribbed" with none of their disadvantages. The result was the well known British Dunlop Traction Tread (Fig. 3) a series of "V" shaped grooves molded at short intervals around the circumference of the tire. This type never gained a foothold in the United States, because it was introduced about the time the automobile was coming into its own and the increasing speed of the newer machines demanded a still stronger tire and better all-around non-skid.

Here again necessity proved the mother of invention and other types of non-skid were brought out to cope with the added danger incident to increased speed. One of the most successful among these was the "Bailey," (Fig. 4) invented by the complexion brush manufacturer of that name, which tread consisted of staggered rows of rubber studs or buttons molded into tread stocks making a design similiar in appearance to the surface of the massage brush. This was indeed a radical departure from the early designs, but it operated so well that it was soon used by nearly all tire makers, who paid a liberal royalty to Mr. Bailey. We were among the rest.

Partly to avoid paying Bailey's royalty and partly because they recognized the advertising value of individual tread designs, automobile tire manufacturers soon began to bring out designs of their own. From the very first, essentials were overlooked and all energy was directed toward producing treads that were distinctive and which in consequence could be featured in advertising. It seems that caution was thrown to the winds; treads were designed that were suicidal to tire life because of the strain upon the fabric or because the twisting of the tread itself developed a tendency to pull it away from the carcass of the tire. Probably the worst offenders against scientific tire design were those whose treads were composed of knobs, studs, or cups so large that under the weight of the car they were forced back into the fabric of the tire, straining it so severely with each revolution of the wheel that after a limited amount of service it gave way entirely.

While this apparently misdirected scramble for individuality was going on, we adhered to the "Bailey" though constantly looking for a better design—one along lines that conformed to the natural workings of the tire itself. Instead of rushing blindly into a tread, we profited by the experience of others, recognizing and utilizing the merits of both the "traction" and "corrugated" treads and avoiding the pitfall of faulty or careless design.

The Safety Tread. (Fig. 5) As a result of the careful study of the development of non-skids and the correct application of all the good features brought out during that period, we have our Safety Tread Tire. One that is scientifically and mechanically correct, the natural and rational outgrowth of evolution in tread designs. The "Safety" as a result embodies not only all the non-skid features of the early types, but what is more important, its design is such that no more strain is carried to the fabric body than is the case with a smooth tread tire. The design of our Safety Tread, consisting of a series of rubber bars with cross ties, gives us:

1—Continuous traction and protection from forward and backward slip.

2—The same protection from side slip that was provided in the early days by the square outside edge of the flat tread tire and the ribs of the corrugated tread.

3—Freedom from strain to the fabric walls of the tire.

That the Safety Tread is effective in carrying out its particular purpose has been positively proven by the service it has given. Motorists everywhere have testified as to its superiority over other Non-skid designs. It does what we claim for it; i. e., it reduces forward and backward slipping, and under ordinary circumstances will prevent sidewise skidding as well.

Goodrich Safety Treads stop the car just where the driver wants it to stop without that sickening, powerless "glide" so familiar to motorists who have had experience with slippery road conditions. The first bar to touch the street rubs a spot clean underneath the tire and keeps it clean for the following bars to grip and hold. The start of a skid, whether forward or to one side, brings into action a straight bar the full length of road-contact which pushes the ooze forward and prevents it from working its way back, thus allowing the bars following to effectually stop the skid.

Since European custom, as well as law, in some cases, dictates that two wheels of every car, one rear and one front on opposite sides, be equipped with tires the treads of which are provided with metal studs or rivets fastened through a chrome tanned leather band, which being cemented and vulcanized to the carcass of a special smooth tread construction, makes, according to many authorities, as positively a non-skid device as can be had. We make metal studded tires only in limited quantities since there is little demand for them in the United States.

The Ribbed Tread which we have used for so long on the Silvertown, is also to be highly recommended; for, it prevents side skidding on the curves and on the front wheels of pleasure vehicles is highly desirable on account of the assistance it gives to the driver in guiding the car. For those who prefer this type of tread to others we offer our Ribbed Silvertown. Smooth Treads are still somewhat in demand for use on front wheels and therefore we supply them in the fabric construction, but the Safety Tread has, however, proven itself to be far more practical than the smooth, even on front wheels, and the difference in cost is so slight that the motorist is more than compensated by buying the fabric Safety.

Invention and History of the Silvertown Cord. Since the days when the first pneumatic tire was first recognized as the boon of the automobile industry, many ideas for improving it have been evolved and patented. Some of these were freakish and entirely impractical, while others were of sufficient merit to attract general attention. However, being no improvement on the then existing types in the manner of their application to the wheel, their wearing and shock absorbing qualities, these numerous patents have been with few exceptions, soon discarded by the leading manufacturers as useless. One exception standing out above all others as not only embodying all the fundamental principles of correct tire construction but as a decided improvement on all types, was the idea of the cabled cord tire invented and perfected in Silvertown, England, in 1904 by C. H. Gray and Thomas Sloper.

Although tire manufacturers soon after the establishment of the first automobile factories had fairly well perfected the regular fabric construction, it was early recognized that the "tire ideal" would be one of one ply of rubber and fabric, or any other material that could "harness air" and at the same time be tough enough to withstand the wear and tear of road service. However, it was found impossible to compound rubber or weave fabric strong enough to be used in the construction of a single ply tire, and therefore, the next step was to attempt the development of a tire of two plies, if possible.

Mr. Thomas Sloper, an Englishman, had taken occasion to visit a bicycle show in London during 1888, where he became interested in a pneumatic bicycle tire, and later purchased a bicycle for no other purpose than to make a study of the structure of this tire. After examining the carcass and finding that it was made of woven fabric, the thought occurred to him that it might be possible to build a better carcass by the use of fine cord as the strengthening agent. Subsequently, he experimented with a thread construction, taking out a patent in 1889 and presenting the idea to leading tire manufacturers. But he was ridiculed by all of them.

With this same idea in mind, Mr. John F. Palmer of Chicago, Ill., later began experimenting on a tire of similar construction, patenting the same in America about 1892; as he had rightly determined that although the fabric tire answered its purpose fairly well, it had its shortcomings. His conclusions were that as fabric tires were built of several plies which must be so vulcanized together that they operated as a unit, and inasmuch as the warp and filler of square woven duck are normally disposed at right angles to each other, it would be impossible to manufacture a tire of this fabric, even when cut on the bias with anywhere near a uniform tension of the threads, without which a tire of absolutely consistent performance could not be secured. Furthermore, by reason of the warp and filler threads being interwoven, and operating under high tension, he concluded there would be resistance to bending or distortion with the added disadvantage that such bending would set up movements in the interwoven warp and filler of the square woven fabric resulting in heat and wear.

Mr. Palmer's conclusions were entirely accurate and even today with fabric tire construction "balanced" and perfected, it is impossible to go beyond the very definitely described limitations of woven duck in attempting to build a multiple ply tire of both maximum strength and maximum resiliency. The difficulty of an uniform tension of warp and weave in the body of such a tire is unsurmountable.

Then again, tire fabric is not woven in sufficient widths to permit its being bias cut, as it must be, in strips long enough to form one continuous length and in consequence there must be one or more splices in each carcass. Wherever such a joint occurs resistance to flexing of the body fabric is doubled and when this is multiplied by the number of plies made necessary to give strength in a fabric tire, the wonder is that they perform as well as they do.

C. H. Gray of Silvertown, England, who had by the way, purchased the English rights to Mr. Palmer's tire and who also had experimented with the cord construction for automobile tire purposes, in partnership with Thomas Sloper of the same place finally came out with a cord automobile tire in 1904. Six years later, the American rights to their patents were purchased outright by the Diamond Rubber Company, and were inherited by us at the time of the Diamond-Goodrich consolidation in 1912. We have since developed and perfected this cord principle to a point where we can say that the Goodrich Silvertown is the strongest and best tire possible to build. In speed, endurance and resilience it has no rival.

The cord tire as it exists today may never entirely replace the multiple fabric construction, on account of its greater cost, but the reader can easily see its superiority and why it is bound in the end to dominate the field.

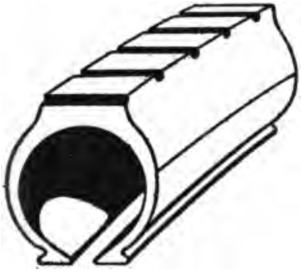


FIG. NO. 1

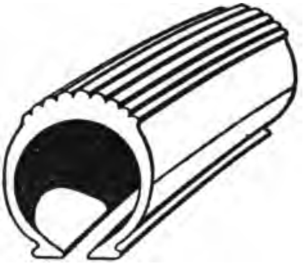


FIG. NO. 2

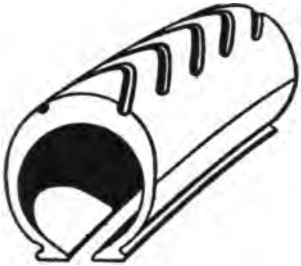


FIG. NO. 3

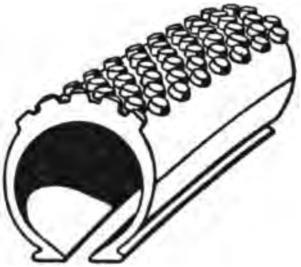


FIG. NO. 4

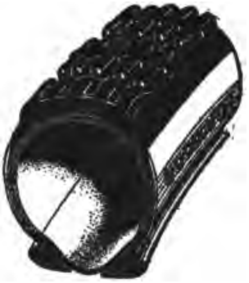


FIG. NO. 5

TREAD EVOLUTION

CHAPTER EIGHT

Automobile Rims

INTRODUCTION. An annular, metal band, the purpose of which is to encircle and hold together the various parts of a wheel, is the formal definition of the word "Rim" as relates to wheel making. This definition is not, however, quite correct, since on an automobile wheel this function is performed by what is termed the "permanent felloe band," while the rim proper is that device which engages and holds the "beads" of the tire in place.

Obviously then, rim development and improvements must necessarily have gone hand in hand with those of the tire. Had the tire makers only realized this at the outset, advancement would have been more rapid, for their greatest barrier was the fact that different types of tires could not be developed—the Dunlop as a striking example, since no automobile rims had been made to accommodate the inextensible bead. In fact, the only automobile rim at first thought practicable was the continuous one piece Clincher, adapted from its prototype the single clinch bicycle rim.

Regular Clincher One-Piece Rim. Clincher Rims are virtually channel rings with their flanges incurved to form hooks designed to engage and hold the beads of the tire when it is inflated. They were originally made in one continuous piece to fit the soft extensible bead of the Regular Clincher tire the only type used between 1900 and 1905. While during this period one piece continuous Clincher Rims were used exclusively because no better type was known, they are at present found only on the lighter cars in the smaller sizes, i. e., those below 32 x 3½, since the soft extensible bead would have a tendency to pull off of one of a greater cross sectional area.

When the one piece Clincher type was in use in the early years of automobile development, it was deemed necessary that the tire be more securely held by means of lug bolts which extended through the felloe and rim, spreading the beads and holding them tight against the rim flanges. These lugs which were made of metal covered with fabric and rubber resembled somewhat roughly a saddle, except that an upright threaded stem protruded from the center, accommodating a cap which screwed down upon the outside of the rim, to draw the lug forward thus holding the beads in their proper relation to the rim.

Imagine a wheel with a number of valve stems protruding between the spokes and you will have some idea of the way the early automobile wheel appeared with its bolted-on Clincher tires. In later years it has been recognized that the air pressure is sufficient to hold the smaller sizes in place and that they will not pull off when rouding corners or under other severe strain, and therefore, lugs are used only on the larger sizes and on racing tires. All regular Clinchers are applied by stretching the beads and thus forcing them over the rim.

Quick Detachable Rims. The Quick Detachable Rim was first produced in 1905 in two types, designated by the terms Q. D. Clincher and Q. D. Straight Side, both of which were constructed to fit the same style wheels as the Regular Clincher. These made possible the construction of inextensible tire beads of hard rubber or wire which rendered the larger sizes of tires safe without the use of lugs and also removed the difficulties attending their application. This rim was bolted rigidly to the wheel the same as the solid one piece Regular Clincher, the difference being that the outer flange was a removable side ring which in addition to making possible the stiff bead clincher permitted the application or removal of the Dunlop or Straight Side tire, as it was afterward termed, to automobile uses; a feat which before this was an impossibility.

This improvement was in fact thought to be the chief advantage of the Q. D. feature, although, as it afterward turned out, few Q. D. rims of the Straight Side type were adopted which fact was doubtless occasioned by the advent of the Universal so soon afterward. The only difference in the Q. D. Clincher and Q. D. Straight Side is that in the case of the Clincher type the flanges are incurved the same as the Regular Clincher, whereas on the Straight Side the flanges are reversed and turn outward. Few of either are in use today.

Universal Quick Detachable. An improvement upon the two Quick Detachable types came shortly after in the form of the Universal, consisting of a base, suitable locking rings, and two removable and reversible ring flanges designed to accommodate either the Q. D. Clincher or Q. D. Straight Side bead. When the former tire is to be applied, the flanges are so placed that the lips curve toward each other, and the rim resembles the Q. D. Clincher. When the latter is to be applied, the rings are reversed so that they turn away from each other and thus resembles the Q. D. Straight

Side rim. The advantage of this rim is, of course, its adaptability to either tire which allows the motorist to use that type which he prefers, and also gives him a double chance of securing service in case of serious tire failure or accident while on the road in communities where small stocks are carried and both types often not immediately procurable.

Standardization of Rims. Previous to 1908, rims had not been standardized and considerable difficulty was experienced by tire manufacturers in supplying sizes that would fit all makes of rims. In 1908, however, the Clincher Automobile Tire Manufacturers Association was formed, its membership including all prominent tire, wheel and rim manufacturers and this Association adopted a standard schedule of wheel and rim measurements which is now in use by all of the rim makers. In order to guard against variations this body employs inspectors, placing one in each rim factory to personally examine and stamp each rim with the Association symbols.

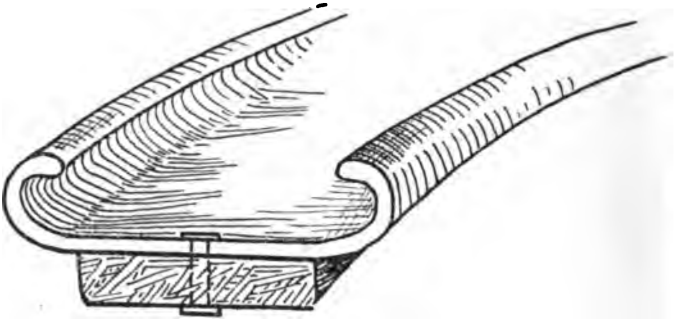
There are three symbols used, one on all transversely split rims, one on rims for wire wheels, and a third on all others and unless one of these marks of approval appear upon the rim, all leading tire makers reserve the right to withdraw their standard service guarantee. This suggests the hetrogenity of sizes prevalent prior to the standardization move. Too much praise cannot be given the constructive work which the Clincher Automobile Tire Manufacturers Association has done; for their recommendations have not only proven beneficial to themselves and automobile makers but the motorist as well.

Demountable Rims. The last, and perhaps the greatest step, in the evolution of the rim came in the form of the demountable feature, by virtue of which the motorist is enabled to more fully enjoy his trips, knowing that should he get a puncture the changing of a tire requires but little exertion and inconvenience. Thru this demountable feature a "spare" may be carried all mounted and inflated ready for use and requires but the loosening of a half dozen or so lugs to remove and replace the damaged tire, rim and all. Nearly all automobile manufacturers have adopted this improved style until today all rim makers are furnishing demountable rims to accommodate all types of tires.

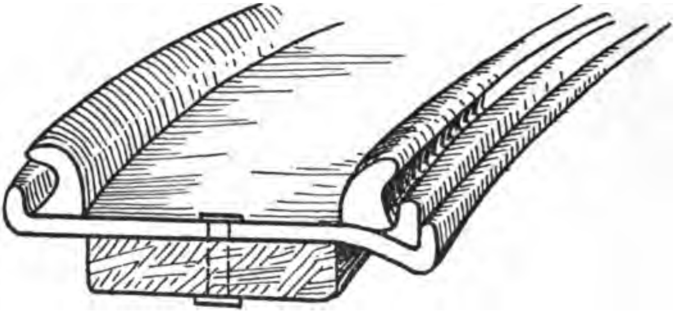
Although demountable rims are standard in dimensions, being made, as they are by different rim manufacturers they necessarily vary in design, that is, in the application of the fundamental principles of rim construction. This is only natural since each maker must build his product along lines so as not to infringe upon other patents. Needless to state that this necessity together with the desire of each to embody in his product certain pet theories is responsible for the many variations in design, such as the "transversely split" one-piece rim, the "circumferencially split" two-piece rim and those which have distinctive styles of removable side rings.

Care of Rims. The troubles so generally experienced by motorists in changing tires from one rim to another is not altogether due to inexperience on their part, but frequently as a result of improper treatment or care of the rim. If pounded with lead mallets or iron hammers, or pried with tire irons, the rim invariably becomes sprung or injured in some other particular, thus multiplying future troubles in tire changing. On the other hand, if no care of the rim is taken whatsoever and the tire is allowed to remain upon it until rusted fast, the same difficulty will be experienced.

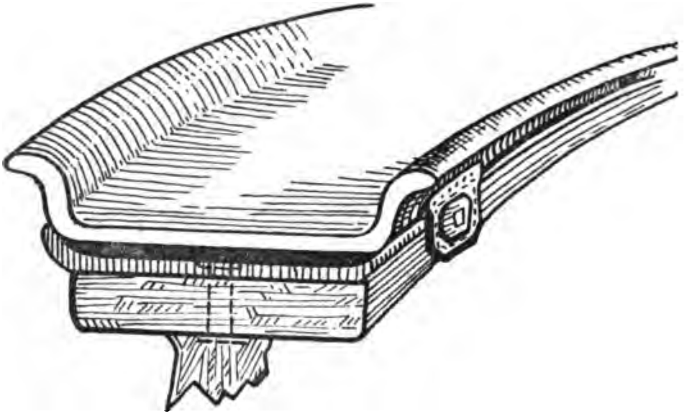
These troublesome and rather expensive annoyances are in nearly every case unnecessary. In removing the tire from its rim a rubber mallet should be used which will accomplish the same results without the damaging consequences incident to the use of lead and iron hammers. Rims should frequently be painted with ordinary shellac or a mixture of graphite and glycerine. The latter although more expensive, has been found in our experience "The Best in the Long Run" for it not only is impervious to the attack of mud and water but makes an almost perfect lubricant. However, most any good metal paint, so long as it contains no oil, will serve the purpose and should be used in preference to nothing at all.



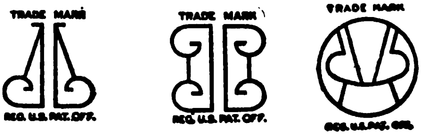
ONE-PIECE CLINCHER



UNIVERSAL RIM—SET FOR STRAIGHT SIDE TIRE



DEMOUNTABLE STRAIGHT SIDE RIM


TRADE MARK
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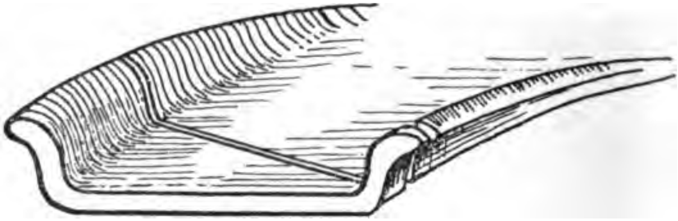
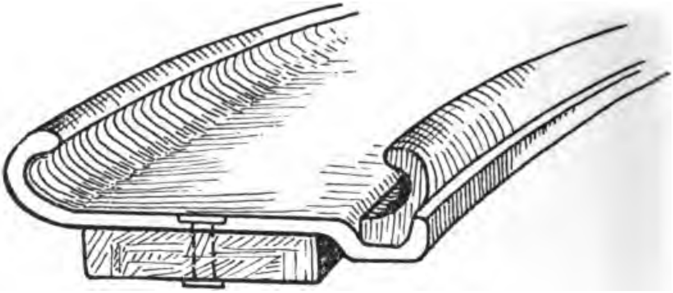
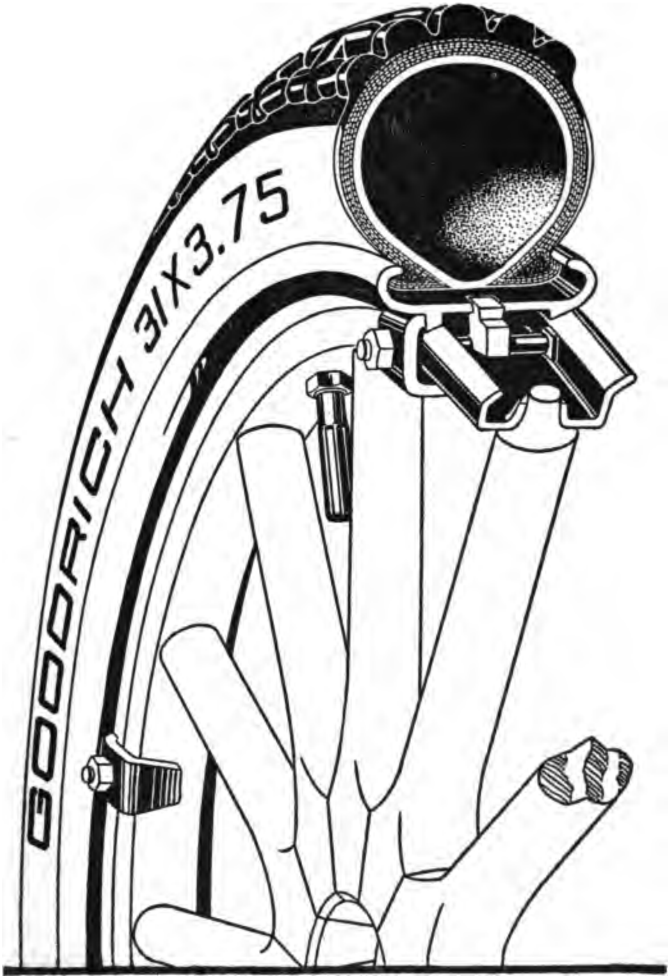
ASSOCIATION SYMBOLS



SPLIT ONE-PIECE MADE FOR STRAIGHT SIDE TIRE



TWO-PIECE QUICK DETACHABLE (CLINCHER)



A GOODRICH WHEEL AND RIM

CHAPTER NINE

Automobile Tire Manufacturing Processes

INTRODUCTION. Since in addition to serving as an important link in the power transmission system of any self-propelled vehicle, the function of the tire, whether solid rubber or pneumatic, is to provide a cushion for the vehicle and its load, obviously that tire is the most efficient which consumes the least power and which affords the best cushion. After many years of experimenting, the pneumatic tire is more nearly supreme today than ever before and, except in certain instances where the use of a solid tire is desirable on account of the slow speed or where the load carried is too great to permit the use of the pneumatic tire, the latter remains predominant. The reason for this dominance lies in the fact that air while cheap offers a perfectly elastic cushioning medium when properly confined. Therefore, the problem of the tire manufacturers is to construct a proper container, and in the following pages we tell the story of how we have solved this problem.

However, before the reader begins this story, it will be well for him to become acquainted with the technical names of the various tire components in consequence of which the following tabulation of those which have become more or less general in their use is given.

Carcass	The plies of fabric which go to make up the body of the tire.

1 *Beads*	The parts of the tire which engage the rim.
Bead-Protection, or Chafing Strip	A narrow piece of frictioned fabric placed around the toe of the bead to protect it from abrasion.
Breaker Strip	A loosely woven, heavily coated strip of fabric placed between the carcass and tread, the purpose of which is to more firmly tie the two together and to break the force of road shocks.
6 *Tread*	That part of the tire which comes in contact with the road.
Filler Strips	Narrow tapes of calendered stock which occupy the space between tread and chafing strips, thereby reducing the hinge action with its ill effects.
5 *Side Walls*	The gum strips covering the carcass of a tire from the beads to edges of the tread.
Flap	An arrangement of rubberized fabrics placed in the opening of the casing, the purpose of which is to prevent the chafing and pinching of the tube. Not used on Regular Clincher Tires.

Fabrics Used. The fabrics used in the construction of the automobile tire are of several kinds, each being carefully selected with the peculiar service in mind to which it will be subjected. For example, "breaker strip" fabric must differ fundamentally from that used in the carcass proper, the bead protection strip fabric from the "flap," etc., and to be assured that these different fabrics will meet their respective service requirements they must be manufactured to conform in every detail to the rigid specifications as laid down by our own experts, and all tested when received by these same "wise-men" of the rubber business.

Compounds. Compounds, as well as fabrics, used in the construction of automobile tires are of several kinds and vary considerably in admixture, according to the several uses. Obviously the compound used in the tread will necessarily differ in ingredients from that used in the friction "coats" of the body fabric, and likewise the compound in making the side walls must differ from that used in the filler strips, for in each instance a different function is performed.

Color is in most cases no proof of quality. Any rubber chemist can mix rubber with pigment to produce almost any hue or shade he may desire, but color that is the result of the combination of ingredients placed with the raw rubber to improve its serviceability is quite another matter and one not so easily imitated. In short, our chemists develop such compounds as appear theoretically to be best fitted for a definite tire need and check them up thru road experiments, revising the formulæ until not only the tread holds up but the complete tire is balanced. When this goal is reached, the tire is marketed no matter what color the compounds appear in, because the thinking motorist wants wear, not hues.

Preparation of Materials. The preparation of the fabrics and compounds in the automobile tire factory is generally accomplished on standard rubber working machinery and differs only in a general way from these same preliminary steps as used in the manufacture of other rubber goods. We have, therefore, described in this chapter only those practices as are peculiar to the construction of the pneumatic tire or differ from like operations in the construction of other goods enough to make it worth the while to point out.

The tread of the pneumatic tire has a service not comparable with or even similar to that of any other piece of compounded rubber, except that of the solid rubber tire, and, therefore, one would expect to find in its preparation a deviation from the usual treatment of stocks. Such at least is the case. From the milling machines the tread stock "batches" are taken to a device termed by the factory as a tubing or "spewing" machine—somewhat resembling a sausage grinder—by which the compounded stock is forced thru a slightly heated die, coming out in a continuous strip of the approximate shape of a tire tread. This strip is cut into proper lengths and these are carefully weighed and trimmed to insure the exact amount of stock being present in the finished article, being then placed on seasoning racks, where they await the call of the builder.

tread

On the other hand, side wall, filler strip and other compounds are merely sheeted to the proper thickness on the regular calender and cut either by means of knives attached to the machine or later by hand. These are likewise placed on the seasoning racks and remain with the other compounded components until required in the building department.

We have left the several distinctive types of fabrics with our "wisemen." They have now passed the "acid test" and we find them in the calender or spreading departments ready to be treated with rubber compounds in a manner according to their texture or the service they must perform. Some are frictioned on both sides, some only on one; others are skim coat on one side, while others pass thru the calender and receive a skim coating on both sides. The body fabric—that which forms the carcass proper—is at first frictioned on both sides and then skim coated on the upper side, which special treatment is given in order to more tightly weld the plies together in the completed tire. The "breaker strip" fabric, on the other hand, because its extremely loose open weave will not permit its running evenly thru the calender rolls, is first stiffened with a few coats of compound placed upon the surfaces by spreading machines, before being skim coated on both sides on the calender.

All fabric passes entirely thru the preliminary processes in its original yardage as received by us from the textile mills; but before being delivered to the tire machines must be cut to proper widths and spliced into lengths suitable for the carcass of some particular tire size which steps by the way may be considered the first in the actual building process. Giant machines or "shears" are used for this purpose thru which the fabric is fed by automatic devices from the roll. Fingers or clips grasp the end of the piece, pulling it thru the machine just enough for the width desired before the blade descends literally shearing it off.

These machines are termed "bias cutters" because they do not cut at right angles to the weave of the fabric, but on an angle of 45 degrees. Biased cut pieces, by the way, conform better to the shape of the tire and also distribute the shock of blows over a greater area of the carcass when the tire comes in contact with road inequalities. From the cutting machine the body fabric is taken to the splicing tables where the strips are joined end to end in such lengths as to make complete tires, the splices being so made, that in a completed tire they will not come over each other, but be at least five inches apart, insuring uniform strength.

The material used to construct the cables for Silvertown cord tires is inspected with the same care as that used in the examination of tire fabrics and after having met our specifications, is wound on bobbins and in groups led thru tubes into cylinders where a rubber solution is forced into the texture under gradually increasing pressure, ranging from 300 to 400 pounds. This pressure forces the air from the threads and the rubber takes its place, thereby preventing air expansion during vulcanization which would hinder the rubber from making the best contact.

As the unit threads leave the cylinders they pass thru a drying mechanism heated to about 140 degrees Fahrenheit, where the solvent in the solution is evaporated and while still warm, proceeds thru a machine where they are twisted into strands. These strands are then rubberized and wound on spools ready for the cabling machine, which in turn twists several of the strands into one cord. The cable after being again rubberized is then taken on reels to the machinery which builds it into the carcass or strength giving part of the tire. But this is a topic which will be discussed later on.

The beads for both fabric and Silvertown tires are constructed in the same general manner, varying only slightly according to the types of tires in which they are to be built. The soft or Regular Clincher bead is made in a continuous strip on a regulation tubing or spewing machine, receiving its frictioned fabric cover as it issues from the die. This continuous strip is semicured, before being cut and formed into circlets for the various sized tires. Inextensible beads, on the other hand, both for Q. D. Clincher and Q. D. Straight Side tires, are made in annular form, the former of fabric and semi-hard rubber and the latter of hard rubber and braided cotton insulated, cabled wires. These likewise receive a semi-cure before being built into the tire; for, like the Regular Clincher bead, they necessarily contain compounds of slower vulcanizing qualities than those of the tire proper and would, therefore, otherwise be only partially cured during the final tire vulcanization.

We now have the different fabrics, cabled cords, beads, etc., treated in various ways and the different compounds prepared in their respective manners, all in readiness to be placed in a product which will have the advantages of all this specialization combined into one unified whole. We may, therefore, logically find our building department a clearing house where the merits of each special practice will find a place to best demonstrate our theories.

Building and Finishing Fabric Tires. The actual construction of a fabric tire is divided into two major steps, viz., "building" and "finishing." The former relates to the shaping of the carcass proper over an iron core, accomplished by machinery which lays the several plies of frictioned, cut and spliced fabric in a continuous strip at an uniformly even tension thruout. During this step the bead cores are placed between two of the plies and are permanently anchored in place by the action of metal discs and rollers which come in contact with the sides and top of the revolving core. These discs not only act upon the beads but exert a pressure against all parts, removing every wrinkle from the fabric and forcing an absolute adhesion between the plies. The tread gum is also applied during this step.

Formerly, and even at present in some factories, fabric is applied by hand. There are still many champions of this method, but the fallacy which they overlook lies in the fact that no man can exert the muscle racking pull necessary to maintain uniform tension on every ply in every tire thruout the day, an indispensable feature of tire building. The last tire made in the evening, by the hand process, is bound to be inferior to the first produced in the morning. Between the two methods there is, therefore, no comparison and when the sales argument is advanced that a hand made tire is, by virtue of its being such, a better article, the exponent is merely endeavoring to justify his inability to equip his factory with up-to-date machinery.

The carcass of the tire is now moved forward on its core to the finishing operation during which the side walls, tread and breaker strips are applied together with the necessary strips of reinforcing gum. These steps in the manufacture of the tire, termed "building" and "finishing" are accomplished by men who have been especially trained in the operation of the machinery and devices used. The tire, insofar as the construction is concerned, is now complete and ready for its cure.

Building and Finishing Cord Tires. As is true of the fabric tire, the construction of the Goodrich Silvertown Cord may also be divided into two primary steps—building and finishing. The building relates to the shaping of the carcass materials over an iron core, which, in this instance, is composed of layers of the rubberized, cabled cord in place of woven fabric. In the finishing the procedure is almost identical with that described in the preceding section.

The carcass of the Silvertown Cord is, of course, likewise machine-built; the ingenious device which accomplishes this work being a patented machine designed by ourselves for this purpose alone. If, however, we should attempt to describe in detail the mechanism of this cord laying appliance, we would soon find ourselves involved in a long and technical discussion which would have little merit in a book of this kind. We, therefore, merely state that the cord carcass building machinery is special in every respect and in no particular resembles the machinery used in the manufacture of other tires. We may, however, mention that this machine is so designed that automatically the plies of the cord are placed over the core, in the form of a helix, under a uniformly even tension throughout, which for the same reasons that makes necessary the cutting of fabric on the bias for the fabric tire, is so adjusted as to place the cords of the second ply at right angles to those of the first, both of which lay at a 45 degree angle to an imaginary line running circumferentially around the tire.

During this building up process thin calendered sheets of high grade gum are so placed that in the completed carcass one appears on the inside and one on the outside, while the others are hidden between the cord plies. The purpose of this gum is, obviously, to eliminate friction between the cables and also to more firmly unite the plies into an integral mass. The finishing commences at this point, i. e., applying the breaker strips, treads, side walls, chafing strips, filler strips, etc., much in the same manner as described in the finishing of the fabric tire.

It would be but natural for the reader to assume from the foregoing that the problems of finishing in each case are much the same, and, therefore, worked out by the same means. Such, however, is not the case, and we find from a study of the principles involved in the construction of this "tire ideal" that while similar steps are taken, the finer points are worked out with a consideration of the construction peculiarities. For instance, the greater resiliency of the Silvertown makes necessary, as a precautionary measure, the adoption of a different type of "breaker strip" to insure a positive adhesion of the tread to the carcass. For the same reason the width and arrangement of the cushion gum and chafing strips must differ from those used in the construction of the fabric tire.

While a careful adherence to the finer details is of great importance to the life of the tire and must be watched over constantly by the factory, a minute knowledge of these things would be of but little benefit to those for whom this book is intended. After all what must be fixed firmly in the minds of our readers are the real fundamental differences in construction which characterize the Silvertown as a tire far above any other that has ever been produced. We make this assertion not without sufficient proof thru experimentation and service, for the Silvertown is constantly demonstrating on all types of automobiles its superior quality.

By virtue of its unique carcass construction—of cabled cord—less of the engine power is dissipated thru heat generating friction always present in thicker side walls, and, therefore, the tire conserves power, which is only another way of saying that it gives greater engine efficiency. Obviously, if a motor has more power there is a greater reserve for hill climbing, less fuel and oil consumption, and quicker acceleration on the straight-away. In addition to these virtues, the Silvertown, being more resilient, will roll farther, thereby permitting a longer coasting range with its resulting rest to the engine.

These same virtues which recommend the Silvertown tire as the "ideal" to users of steam and gasoline driven vehicles also prove its superiority as equipment on electrics. Everyone will recognize as most suitable for vehicles of this type that tire whose extreme resiliency prolongs the life of a battery charge and yet whose sturdiness is such as to provide safety and economy in operation. Tires by the score which have been constructed especially for electric vehicle service have included one or the other of these necessary features (strength and resilience), but have failed by virtue of their lack of the other, so admirably combined in the Silvertown.

The tire experience of both manufacturers and users of electric vehicles has been bitter, indeed. Although it was recognized from the start that pneumatic tires were the ideal equipment for vehicles of this type, it was also recognized that there were some objections to those of ordinary fabric construction in that they constituted a drag upon the batteries, by reason of their comparatively unyielding carcass, and this was measurable in dollars and cents in those days of high battery costs. In overcoming this question of battery consumption by greater resiliency, both the manufacturers of tires and manufacturers of vehicles lost sight of all other elements in their endeavor to furnish a tire of utmost efficiency. Among the scores of special electric vehicle tires designed, were the so-called "Power Savers," made after the Palmer-web method, and these were, indeed, resilient. But the manufacturers had gone so far in their efforts to secure this resiliency that strength was sacrificed, and in consequence, tire troubles for the user were the rule rather than the exception.

This condition led to the other extreme and a solid cushion tire, which came on the market at that time was offered as the panacea for all tire ills. Tire trouble, it is true, was obviated by the adoption of this type, and because of this and their sad experience with the extremely resilient pneumatic, users were influenced in their choice. In consequence, manufacturers of electric vehicles were forced to supply this solid cushion tire as original equipment.

It will not require such a tremendous stretch of the imagination on the part of the reader to understand that the electric vehicle with its solid tire did not furnish the most pleasurable ride imaginable, especially over rough pavements, and that in addition to its rough riding qualities, the solid cushion tire set up such a vibration that not only were the batteries smashed, but the entire mechanism crystallized and destroyed. It was not long until the owner of the electric vehicle perceived that the solid cushion tire was not satisfactory for his service and again demanded a special pneumatic. *The Silvertown Cord with its combined strength and resiliency, supplies his every want.*

Not only does the Silvertown do its work better, but does better work for a longer length of time, which is due to the fact that the cabled cord construction in addition to being stronger than the many ply fabric type, will flex farther and return to its normal shape quicker, since there is neither weave nor cross threads to become stretched. The Silvertown is, for this reason, virtually immune from the abuse known as stone bruise so prevalent in fabric tires. While this tire may represent a greater initial investment, its added strength which minimizes troubles incident to motoring, more than offsets the additional outlay, and the motorist can, therefore, be assured that he is receiving not only the worth of his money but an immense amount of satisfaction impossible to measure in dollars and cents.

Inspections. Although we have made no mention of the inspections given during building and finishing of both fabric and cord tires, the reader must not assume that they are merely built by the men and machines without supervision, for as a matter of fact, each and every operation, no matter how trivial, must be passed upon by an inspector before the building or finishing can be continued. These inspectors are graduate tire builders, as it were, selected on account of their knowledge and training in the art, and each one is apportioned a certain definite number of machines and men to check up. These overseers are in turn checked up by means of numerals which are molded into the rubber, where they will not become obliterated in service. If a tire is returned as defective, and it is found to be due to faulty construction, the inspector as well as the builder is brought to account, which procedure causes both men to exercise the greatest care and exactness in their respective duties, thereby giving the trade a product as nearly perfect as can be made.

Tire Types. As the reader may have inferred from our discussion of rims, there are three distinctive types of tires no matter whether they are of fabric or cord construction, viz., Regular Clincher, Q. D. Clincher and Q. D. Straight Side, and their difference in every case centers in the makeup of the bead. If the tire has a soft and extensible bead permitting it to be stretched over a one-piece rim, it is termed a Regular Clincher. When the Clincher bead is constructed of hard rubber and fabric rendering it inextensible, the tire is termed a Q. D. Clincher and is applicable only to a split or removable side ring rim. The "straight bead" tire is likewise one having inextensible beads. In this type the beads are usually made of braided or cable wires built into a core of semi-hard rubber and fabric with no hooks or heels such as appear on the Q. D. Clincher, but flush with the outside of the casing which difference in construction is the real distinction between the two types. One of the main features of the Straight Side is its slightly greater air capacity, due to the flanges of its rim diverging in place of converging, allowing the beads to spread somewhat.

It will be remembered that in the early days when nothing but Regular Clincher soft bead tires and one piece rims were in use that all were supplied with lugs and made without flaps, and that it was later determined that Regular Clincher tires above 3½ inches cross section diameter were unsafe without the use of lugs. While it is true that this rule is still pretty generally followed, later improvements in bead construction have eliminated much of the risk and made possible the use of 4, 4½, and even 5 inch Regular Clincher tires on Q. D. rims by the simple expedient of having them equipped with flaps. However, since the use of one piece solid rims is now confined to the smaller sizes, this question will be rarely met with.

Regular Clincher tires are interchangeable with Q. D. Clincher, but the reverse is not true, and the user should never attempt to apply a Q. D. Clincher tire with its stiff inextensible bead to the one piece rim.

Regular Clincher tires are made in the smaller wheel sizes because in these sizes they work just as effectively as the Q. D. Clincher, and are somewhat cheaper to build. When we get into the larger sizes, however, Regular Clinchers with their soft beads will not stay on the rims, consequently, either Q. D. Clincher or Q. D. Straight-Side are used, with the demand somewhat in favor of the latter type. Some prefer the Q. D. Clincher believing that it seats better and holds more firmly to the rim, while others favor the Q. D. Straight-Side because of its added air capacity.

Q. D. Clincher tires are not interchangeable with Q. D. Straight Side, except on Universal Rims, where the side rings can be reversed, and never under any other circumstances should this interchanging be attempted.

Tire Balance. Regardless of the type, size, tread, design or material used, there are certain rules of construction that must guide the manufacturer who expects to produce a perfectly balanced tire, i. e., one exactly proportioned in all its component parts. He must remember at the outset that the tire with the least rubber and fewest fabric plies possesses the greatest resilience and is least liable to heating and consequent deterioration. The "tire ideal" would be constructed of but one ply of fabric covered with a thin coating of compound. Unfortunately, this is not possible for there must be several plies, the number depending upon the cross sectional diameter of the tire, in order to secure the proper strength. Furthermore, there must be enough compound to hold the tire together, protect the fabric from the elements and give resistance to wear.

Since strength and wearing qualities are attained only in the above manner, the manufacturer must check himself in his desire to produce the strongest possible carcass or else he will defeat his own ends by producing an over-loaded tire; that is, one which would not only destroy itself by its own internal friction and consequent heat, but one which would be a drag upon the motor. Therefore, the end toward which all successful tire manufacturers must strive is a middle ground approaching the "tire ideal," but still producing a product of proper strength. This practical "Ideal" as it were, cannot be embodied in a tire unless a perfect equilization of every part is present. It must be constructed on a well-balanced basis so that the fabric, the side walls, the tread and the bead all wear in direct proportion to the strongest possibility of mileage of its weakest factor—The Twentieth century "One Horse Shay."

Periodically some new company enters the field with a tire containing an excessive number of plies of fabric or an unusually thick tread, advancing either or both as indicative of quality and durability. Nothing could be farther from the truth or more certainly brand that manufacturer as "Inexperienced" and his product "faulty." All experienced tire men know that too many plies of fabric will cause the carcass to heat quickly and excessively, and because of the heat thus generated by the excess material the "friction coating" will deteriorate and the several plies of fabric separate. Furthermore, too heavy a tread not only assists in generating heat, but because of its bulk nearly always separates itself from the carcass. Tires of this sort seldom remain long on the market.

Vulcanization. No matter how near their theories and principles of tire building approach perfection, the manufacturers' efforts are never crowned with success unless the tire be properly vulcanized. As the finest dough kneaded by the most up-to-date appliances is unpalatable unless properly baked, so the engineers' deserving efforts in tire building are never actualities unless the rubber dough is likewise scientifically baked. If over-cured it will be hard and lifeless, while if under-cured the stock will remain putty-like and, therefore, lack the desired resiliency.

It is not our purpose to open up a discussion regarding the merits of other methods used in the vulcanization of automobile tires, but merely to explain the Unit Mold Method as exemplified in our products, allowing the reader to draw his own conclusions.

The oven or vulcanizer by which the unit-cure is effected is an appliance closely resembling an ordinary steam boiler. This is so installed that its opening comes flush with the delivery point of a conveying apparatus, which facilitates the loading and unloading. Previous to being placed in this vulcanizer, each tire is incased between the halves of an iron mold, the interior surface of which is milled with the matrix of the tread design desired. From 18 to 25 of these molds are then placed upon the elevator or car which carries them into the cylinder, after which the cover is clamped securely in place, hydraulic pressure applied, and live steam passed around the molds. The pressure of the ram serves to force the tread stock into the mold cavities where the heat brings about that peculiar change in the compounds giving the tire its permanency of form. The tire then comes out of the mold a live, resilient, tough UNIT—in fact, the Goodrich tire as the user knows it.

This unit mold process, of which we have been the leading exponent, from the beginning, in all lines where it can be used, accomplishes two things impossible of attainment thru other methods, and we believe is the chief means whereby the uniform high quality and long wearing properties of Goodrich tires have been made the standard toward which other manufacturers strive. This is evidenced by the fact that other leading companies one after another have been adopting this method and endeavoring to adapt their compounds to it.

First, by the unit mold process, under the enormous pressure exerted by the ram the molecules of rubber are more firmly knit and the natural porosity of this material, is in a great measure checkmated. Second, by this process every component part of the tire is finally and definitely welded into one unit; and, furthermore, in the accomplishment of the step, the dangers of over or under-cure are reduced by one, over any method where two cures are necessary to complete the article.

Serial Numbers. Before the mold is closed over the tire, the serial number matrix is applied to the sidewall in the form of a small piece of tin which has the desired number in negative bas-relief. During the process of molding this number is impressed upon the surface making it easy for the owner to identify his tire and the Manufacturer's adjusters and sales people to determine the exact age of any unit.

Inner Tubes. Although the general public is being educated up to a point where they see the necessity of purchasing high grade automobile casings, it is, nevertheless, just as true that many fail to realize the importance of also securing first class inner tubes. Those who would not think of using a cheap carbonizing oil in their motor oftentimes will put "any old" tube into even a new Silvertown. They fail to recognize the simple fundamental that the life of the tire, and even the life of the driver, may depend upon the ability of the tube to "deliver the goods," and that many a good casing has been ruined by a poor tube.

Probably due to psychological reasons there has sprung up a demand for a colored inner-tube, either red or brown, which manufacturers are bound to recognize. It is doubtful whether a brown or red tube will out-wear a gray or pure gum tube though they are, if properly made, slightly tougher than tubes of gray stock, and are, therefore, probably less susceptible to pinching and perhaps harder to puncture. To get, however, a colored tube that will have the same life and be as proficient an air retainer as the gray tube requires considerable more skill; consequently, red and brown inner-tubes must cost a trifle more.

Goodrich Brown and Diamond Red, embodying the highest compounding art, are the two brands which we offer for this demand along with our Goodrich and Diamond Gray. We feel safe in making the statement that both Goodrich Brown and Diamond Red brands not only answer the psychological desire, but give the buyer enough added toughness to counterbalance their additional cost over gray tubes.

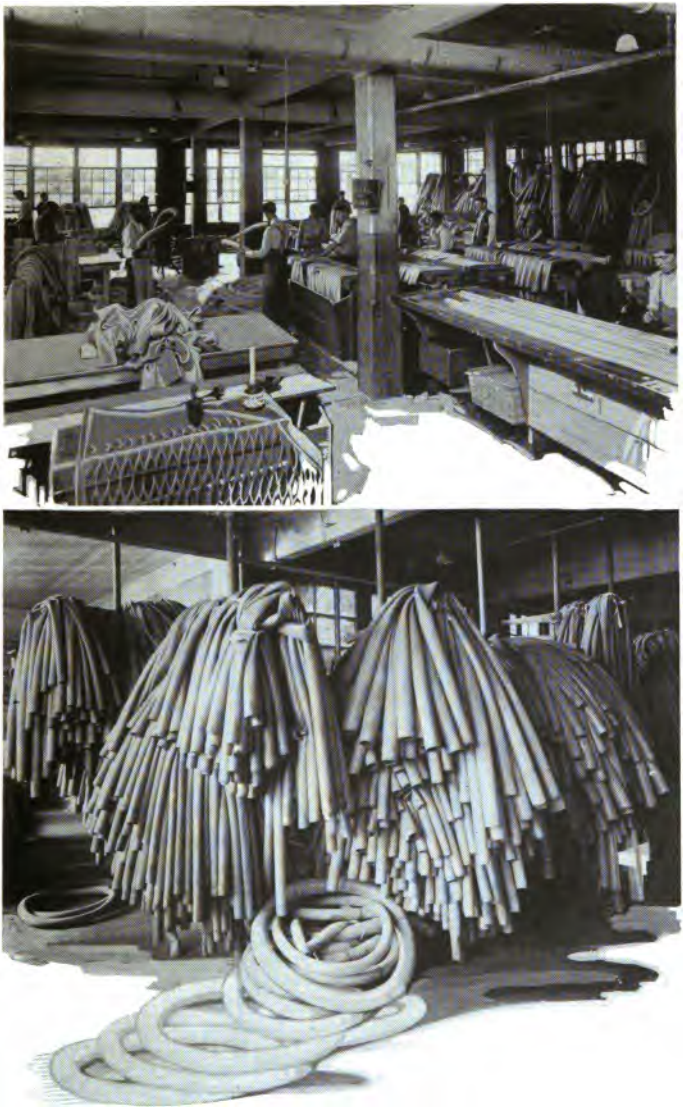
Goodrich inner-tubes are made from multi-ply sheets run on standard calenders ply upon ply. The stock is reversed as each ply is superimposed, and this laminating process not only serves to eliminate pin holes, but makes the final sheet stronger by reason of the change in the direction of the grain. As this laminated tube stock issues from between the rolls for the last time, it is cut by adjustable knives attached to the machine into widths as desired for the various size tubes.

When this stock is pronounced perfect by the inspectors, it is ready to enter the tubing machine invented and patented by a "Goodrich" mechanic, which ingenious piece of machinery cuts, cements and forms a butted seam as the stock passes thru on a small conveyor belt. A butted seam is the name applied to a connection formed by cementing two edges together face to face in place of capping one over the other. From the folding device, on the same belt, the tube is carried a specified distance—scientifically calculated to dissipate just the proper proportion of the solvents from the cement when its destination is reached—which is the butt seam machine, where the final welding is accomplished by means of rolls and an automatic trip-hammer. As this tube is delivered from the machine it is cut into definite lengths, depending on the circumference desired in the finished article. A gum and fabric composition valve pad is now placed near the center of each length and they are then slipped over mandrels. After a capping is applied to the ends, dampened cheese cloth tape is wound tightly around the tube by machinery, and these tube covered mandrels are then racked on a carriage and run into a horizontal vulcanizer known as an "open steampot heater," where they are subjected to the effect of live steam until completely cured.

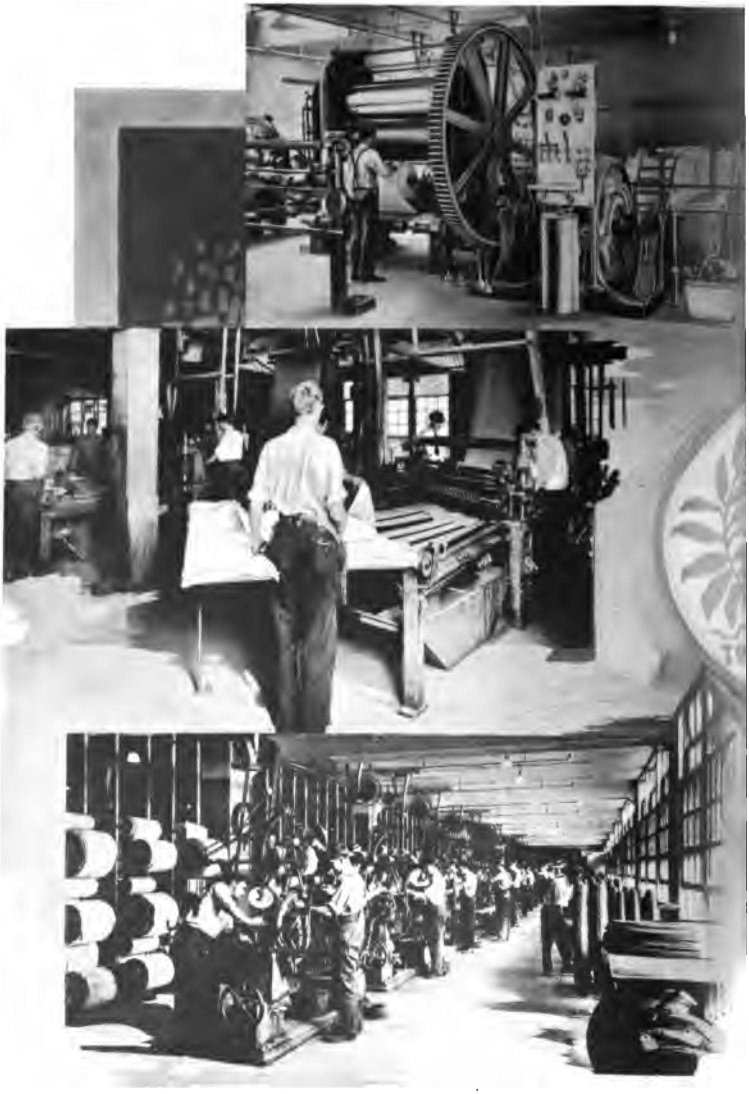
After being removed from the vulcanizer, the now nearly completed product is unwrapped and stripped from the mandrels, thereby bringing the smooth surface which was cured next to the mandrel on the outside, leaving the roughened surface occasioned by tightly wound rags inside of the finished article. Some manufacturers merely slide the vulcanized tube from the mandrel, leaving this roughened surface visible, and this marking they point to as evidence of a strictly hand made tube and a feature of some special merit which they do not disclose. We, however, believe that the rough surface causes more friction between the casing and the tube and, therefore, furnish them as we do.

Into the center of the valve washer or pad now cured as an integral part of the tube a round hole is next punched, thru which the valve parts are later attached. Each end of the tube is then buffed to insure better surfaces for adhesion at the splices when the ends are put together. This last mentioned operation is accomplished by means of a pair of ingenious devices known as "split mandrels," over which the ends of the tube are folded, buffed surface outward, and coated with "cold cure" cement. Just previous to making the splice proper, the workmen subject these roughened and cemented surfaces to a Carbon-Di-Sulphide bath which acts as a vulcanizing agent, effecting what is known as a "cold cure."

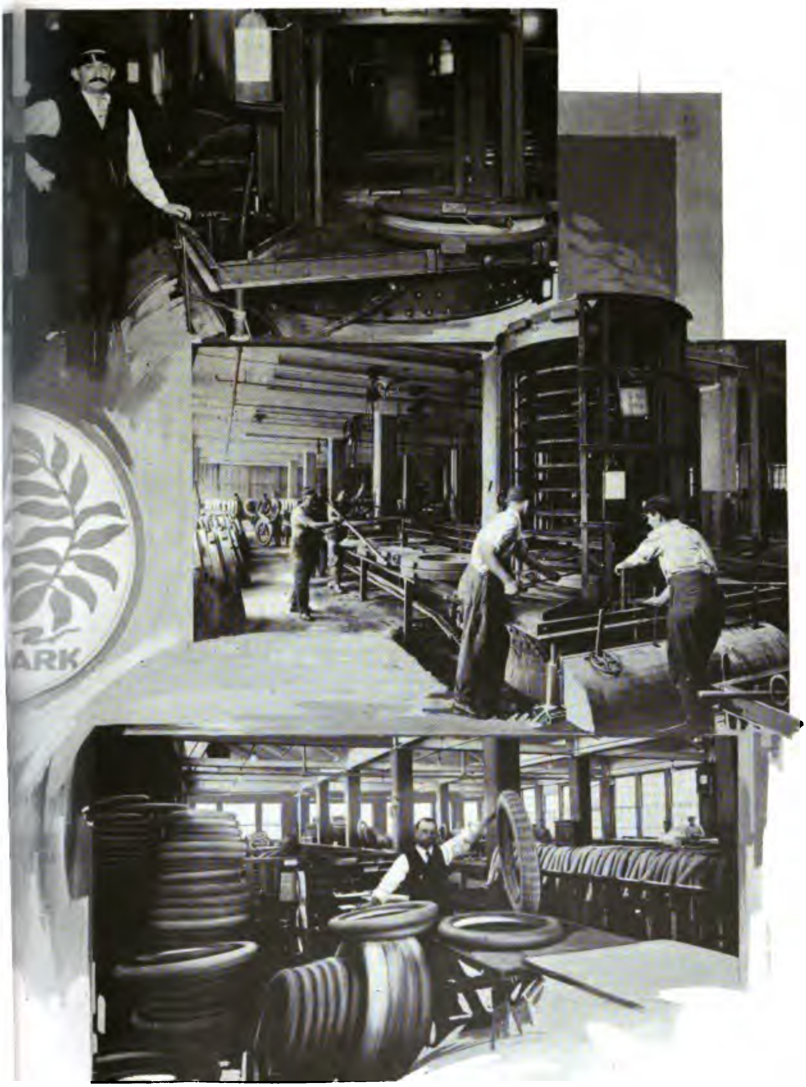
Although complete when spliced insofar as construction is concerned, inner tubes are not folded and boxed for shipment until a most thorough inspection is given to each one. This includes not only observing the general appearance, but also involves a test for leaks made by inflating and submerging into a tank of water each tube that passes the inspectors' hands. Thus it will be seen that there is slight opportunity for a defective tube ever reaching the ultimate consumer.



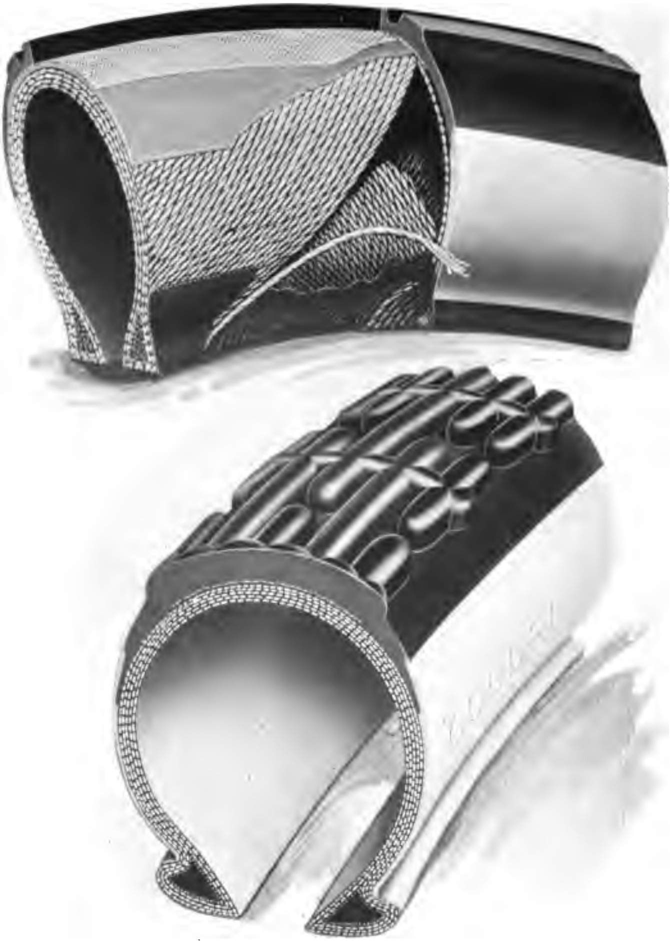
INNER TUBE MAKING



FRICTIONING
CUTTING FABRIC INTO STRIPS
TIRE BUILDING MACHINES



PUTTING INTO MOLD
VULCANIZING ROOM—TIRES
INSPECTING



THE FINISHED GOODS

CHAPTER TEN

Automobile Tire Service Abuses

GUARANTEE. All pneumatic automobile tires bearing the Goodrich or Diamond brand and serial number are guaranteed to be free from defects or imperfections in material and workmanship. Tires returned for consideration under this guarantee will be accepted only when all transportation charges are prepaid. If, upon examination, it is our judgment that such tires are defective they will be repaired or replaced. When tires are replaced by us charges will be made to their owners at the time new ones are delivered for such amounts as in our judgment will compensate for the service rendered by such replaced tires, making the adjustment on a thirty-five hundred mile basis, the point where it has been determined by experience that a defect will show up.

Tires worn out in usual or unusual service, abused knowingly or unknowingly, misused, used on rims not bearing the rim association stamps or injured thru accident or design, are not covered by this guarantee.

Our pneumatic automobile tires are not warranted to give any definite miles of service, and any and all guarantees are expressly waived by the purchaser who uses them under weights in excess of those for which the various sizes are recommended, or who does not keep them inflated to the pressure recommended by us.

We have always recognized the rights of both consumer and dealer to fair adjustments in such instances as we have failed in either quality goods or quality workmanship. But, it has been estimated that 50% of the tires becoming unfit for service are not actually worn out, but are rendered useless thru accident, neglect or abuse. Although but a small percentage of those prematurely discarded thru these causes are ever returned to the manufacturers, it has been established thru statistics that in a large majority of cases adjustments are made on a more liberal basis than circumstances warrant.

When we stop to consider the service the tire must perform in protecting the car's mechanism against crystallization and in applying the engine power to the road surface, it is readily observable that even under the most favorable conditions the demands are extremely severe. These normal severities are provided against in the construction of Goodrich and Diamond tires, but no tire, regardless of its strength or quality, can be expected to withstand accident or neglect, or to deliver its full quota of service, if subjected to abuses.

Adjusting. Our Service Department, which is amply represented at every Goodrich branch, is the division of the organization inaugurated for the handling of all claims of such a nature. This department is in reality a fraternity of tire experts, who are known as "Adjusters," and it is their duty to assist the users of Goodrich tires to better mileage by advising them as to the care of tires and the abuses to avoid. It is the primary duty of these adjusters to consider all complaints where it is claimed that tires have not fulfilled our guarantee, making in such cases, where it is found that one has not delivered its full mileage thru faults in construction, an agreeable settlement with the customer. If on the other hand, it is patent that failure is due to abuse, accident or neglect, it devolves upon the adjuster to convince the user of such, at the same time pointing out to him tactfully how a repetition of the cause may be avoided.

That the reader may be familiar with some of the more or less common abuses and their results, we will outline and give a brief description of each in the following paragraphs.

The Use of Chains. Although chains under any circumstances are more or less injurious to tires, experience teaches us that the greatest amount of damage comes from using them on paved streets where they are least needed. While it is true that under certain conditions chains are indispensable to safety, it is also true that there are proper and improper methods of application.

Where the chain is held rigidly in one place by being clamped to the rim or spokes, great harm to the tire may be done in a few miles, for this concentrates the cutting and grinding action of the cross links against the tire to a certain small area. Thus eventually the tread is cut thru to the fabric, and in many instances actually loosened up and torn from the carcass. This condition does not indicate a weakness in the tire as is so often supposed by the layman, for there are none but what will succumb to similar treatment.

The least injury resulting from the use of chains will be found where they are loosely applied and have play enough to work themselves around the tire, distributing the strain to all parts alike. In such instances where it is necessary to utilize chains, the motorist can get the best results by first securing the proper kind of a device, and second by seeing that it is applied in the approved manner.

Tread Cuts. If cuts extending thru the tread to the carcass are neglected, fabric deterioration and blistering of the tread are bound to result. Evidences of such neglect will be readily apparent in the form of blisters or bumps near where cuts of this nature occur. These are caused by sand and water working under the tread which soon ruins the tire.

Cuts are bound to occur, but they need cause the motorist a small expense and little inconvenience, for if taken when first made a very simple repair will securely close them against the entrance of foreign material. It is even unnecessary to remove the tire to make such repairs, and any motorist can by first thoroughly cleansing the gash with benzine use a simple preparation known as "Plastic," which we supply, and which can be depended upon to effectively ward off further deterioration.

Bruises. A careless driver is prone to disregard the injuries which may be done to his casing by speeding over railroad crossings, by racing thru chuck-holes and by slamming the car against the curb, because such things result in what might be termed as internal injuries and do not frequently show on the outside. Any one, however, who stops to consider the construction of a tire will know at once that the inner-ply of fabric is less in circumference than the outer, and, that therefore, what really occurs when the tire is subjected to these pile-driver like blows is that the inner-ply is stretched to a greater circumference than the outer, which causes its rupture.

Many motorists refuse to see this, and no amount of argument can convince them that a tire which blows out in a garage or standing quietly on the street, has at some previous time been injured in the above manner, and not a defective product. What really has happened is that thru constant action of the fabric plies an injury, although perhaps slight at the start, has gradually opened up, resulting in such a weakening of the carcass that it would no longer sustain the pressure. In many instances the blow-out will follow thru the fabric plies and occur several inches from the original bruise.

Rut-Worn. We have all seen tires from which the side walls were entirely worn, leaving the edges of the seemingly intact tread to flop loosely back and forth. This condition is commonly termed as "rut-worn," although it may be occasioned by rubbing against the curb or in running thru frozen mud the crust of which is not of sufficient strength to sustain the weight of the machine. Each of these causes has the same effect as holding the tire on a revolving grind-stone, and it will be readily apparent to any reader that even steel could not stand up under such treatment, much less a rubber compound.

Prematurely destroyed side walls in no way indicate defective material or workmanship in the tire, and the careless driver who insists on using the curb for a brake, or following the ruts of frozen roads, must decide to pay the penalty.

Skidding. The results of skidding are easily seen for the tread appears worn or rather scraped from the carcass in spots, which injury oftentimes extends even to the innermost ply of fabric. This condition is seen most in hilly localities, and it is brought about either by a too sudden application of the brakes or thru a faulty adjustment of the brake-bands. It is patent that sliding the wheels under the weight of a heavy car is bound to act as an abrasive agent, literally burning up the tread. This may occur only on one of the rear wheels thru an improperly adjusted brake-band which allows one wheel to revolve while the other at the slightest pressure of the brake sticks at a given point.

Running in Car Tracks. It seems to be one of the great temptations to motorists, especially in towns where the pavements are in need of repair, to use the car tracks as a speedway. If automobile tires were intended for use on car tracks they would surely be equipped with flanges and it does not seem necessary for us to point out the evil effects incident to this form of abuse. But, if there is any doubt in the reader's mind we suggest that he either experiment with a set of tires or observe those on the car of some one who follows this practice.

This is one of the worst abuses to which a tire can be put, for while other injuries can oftentimes be repaired, a tire that has been constantly run on car tracks is beyond all remedy. Not only will the side walls be in time chewed away, but the fabric will be blistered around the entire circumference, thus rendering a repair impossible. Continued running in ruts or scraping against curbs will work the same injury.

Under Inflation. With an ordinary air compressor line as used in garages, or with a hand pump, it is almost impossible to over-inflate a tire to a degree where injury will be done. On the other hand, under-inflation is the prevalent cause of premature tire failure, and more motorists will be found with their tires under-inflated than those running tires with proper air pressure.

Not only is a properly inflated tire better able to carry its load, but it is far less liable to injury, from the fact that the comparatively hard round surface of the fully inflated tire offers more resistance to small objects lying in its path than does a flat, flabby, partly inflated one. Take for instance, so familiar an object as a stone lying in the road; the rounded tire will actually knock this out of the way without receiving the slightest injury, whereas the under-inflated tire will roll over it and oftentimes cut itself more or less badly in the act.

Constant under-inflation of tires, due to the abnormal distortion set up thereby with its consequent excessive heat, causes a weakening, breaking and separating of the fabric in the side walls. Further, the tendency to rim-cut and creep will be increased by soft riding. The evils of under-inflation will not only be evidenced in an unusual number of cuts and bruises, but also thru the general stretched and unshapely appearance of the carcass.

Many tires are run under-inflated because the autoist feels that thereby he receives more comfort in riding. Many tires are run with insufficient air pressure thru pure carelessness. There are, however, a few careful drivers who are still basing their tire inflation on the time worn fallacy that the volume of air varies considerably with temperature, i. e., that standing in the hot sun or driving on hot pavements will cause a marked increase in pressure resulting in over-inflation and consequent blow-outs unless this is taken into consideration at the time of inflation. It has been found, however, that what little natural expansion does take place is so slight as to be negligible.

Overloading. By the average person it is generally believed that the results of overloading must be the same as those caused by under-inflation. Indeed, there are even many engaged in the tire business who are laboring under this misapprehension. Nothing could be farther from the truth, and although just as detrimental to the life of the tire, the effects of overloading will be seen in an entirely different form. It is not our purpose to here attempt the technical explanation of this seemingly analagous situation; this we leave for the engineer, but one thing we do wish to mention is, that, regardless of whether the tire carry its normal inflation, or be over-inflated in the hope of overcoming the overload, the results will be the same—a circumferential split of the fabric plies at the "hinge."

Faulty Wheel Alignment. Improper adjustment of the steering apparatus, a bent knuckle or axle will cause a wheel to toe in or out, which incorrect angle will sooner or later grind thru the tread of any casing. This generally occurs on the front wheels where either one or both may be affected. We know of one instance where after an axle had been slightly bent, resulting from an accident, the two front tires were worn entirely thru, and the inner tubes blew out in the short space of fifty miles.

All cars are sent out by the manufacturer in perfect alignment, but after being run awhile, the steering gear, if not watched closely, is apt to become affected. To aid in steering, the front wheels are permitted to "toe in" just a little, about one-eighth inch, but if allowed to do so to any marked degree ruined tires will be the result.

Improper Application. The disastrous results of improper application of tires to rims are so obvious that the reader may feel that the mention of such has no place in even an elementary text. However, from experience we have found many who have been guilty of mis-application of the grossest nature, and for this reason we mention them along with their results.

Q. D. tires if applied to Straight Side Rims will bring about a flattening of the bead lip, eventually causing it to be torn loose from the casing. A Straight Side tire if used on a Q. D. rim will become chafed and broken above the bead at the points where the curve of the rings come in contact with the side walls of the tire. How this rim cutting comes about can be easily imagined when the reader remembers that since there is no lip to the bead of a Straight Side tire there will be but a very narrow line of contact between the side-walls and the rings. Repair is usually impossible in either case.

Tires applied to rims with bent or damaged flanges soon wear out at the bead and become useless. Tires improperly applied, even when used on the correct rims, will likewise suffer the same premature end; as for instance, if the flap is allowed to protrude between the bead and clinch of the rim a proper seating of the tire cannot be secured, and thus it will be allowed to chafe at this point.

Tire Fillers. A pneumatic tire casing is designed for use with compressed air and when so used and it receives a blow from an obstruction in the road, the shock is evenly distributed. In other words, owing to the support of the elastic air-cushion the carcass absorbs the concussion, turning the blow aside with little or no injury to either itself or the machine.

When a filler is used, the blow is localized in the immediate proximity of the point at which it is received, and the strain falls in one place, thereby weakening the carcass. Constant repetition of these shocks causes the casing to disintegrate and wear out prematurely. The resiliency of any tire filler furthermore rapidly decreases with use, and, as the casing stretches the filler does not follow up with a constant pressure, whereas air being a gas, maintains an equalized pressure continually, regardless of the flexing and stretching of the casing.

Inside Protectors. The present high price of tires makes car owners more than ever keen to find some way of lengthening the life of their tires, i. e., increasing their tire mileage. A good Reliner or Protector inserted in a casing after it has been run to a point where it begins to show signs of weakening, will in nearly every instance be a wise investment.

In a new casing, however, a Reliner would be a detriment in more ways than one, although in an old casing it acts as a reinforcement and many a one that would otherwise be consigned to the junk pile, or possibly returned to the manufacturer for adjustment, may be continued in service until actually worn out. This is true conservation.

Leak Sealing Fluids. Various fluid preparations,the purpose of which is to automatically seal punctures and stop leaks in the inner tube are constantly being brought to the attention of the autoist. There have been many of these brought on the market in the past, and there will probably be many more advertised; and as time goes on the question will constantly be popping up as to the merits of these various "cure alls." Since many of these are injurious to rubber, the use of none should be approved unless sanctioned by the rubber chemist. It is true that there are such preparations which do the inner tube no harm, doubtless, performing very satisfactorily all that is claimed of them. However, since large cuts and blow-outs cannot be sealed by this means, their recommendation is of doubtful value.

Gas for Inflation. The question of using gases other than air for inflation (carbonic acid, hydrogen, etc.,) is constantly recurring. That the reader may at once and for all settle this much mooted question, we will state here that their use is condemned for three reasons. First, air costs nothing, and no more elastic nor better cushioning medium has ever been found. Second, many gases are injurious to rubber; and third, many of the lighter ones seep rapidly thru the tube stock, as evidenced by the fact that even with air one element, nitrogen, escapes faster than the other, oxygen. The disastrous results then of the use of gas may be threefold, i. e., greater expense, disintegration of the tire and injury thru under inflation.

Careless Application. Ninety per cent of all tube troubles are due to pinching from improper application of the tires to the rims. Either the flap gets misplaced or a tire tool being punched against the tube causes it to catch underneath the bead at some point and thus it becomes creased, eventually resulting in a blow-out. Outside of tubes that are pinched by a break in the fabric caused from a bruise, practically all trouble, when there is no outside evidence of injury, is traceable to careless application.

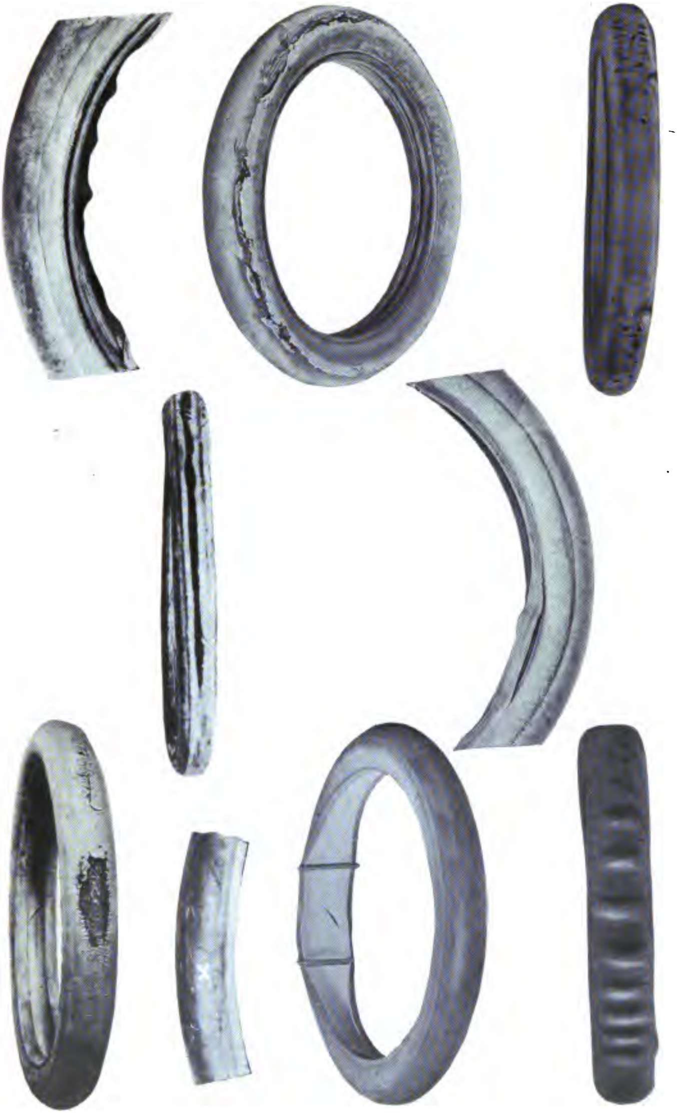
When mounting the tire, the tube should first be slightly inflated and the hand slipped around inside the casing to insure that there are no wrinkles. The flap, if any, should be put in position in the same way. After the tire is on and before final inflation, the bead should be raised all around with a tire tool to allow the tube to escape into place if the beads are pinching it at any point. See that lugs, if used, move freely up and down and that the valve is properly seated. Attention to these particulars will prevent subsequent trouble.

Care. There are several simple practices which will materially prolong the life of a tire, and, although a description of these does not logically fall in a chapter on abuses, we know of no better place to discuss them than at this time when a tire's serviceability is naturally foremost in the reader's mind.

At all times the tread should be kept free from oil and grease, and the machine should not be allowed to stand in puddles of gasoline, since all of these are natural enemies of rubber. Regardless of the apparent condition of a tire, it should be at stated intervals removed from the rim and thoroughly powdered on the inside with "tire talc," the perfect rubber lubricant, to insure a freer action of the inner tube, taking care not to use too much.

Age has little effect on the wearing qualities of tires if they have been properly stored. By such, we mean kept in a cool, dark room, away from the direct action of the sun's rays. Tires so kept will actually increase in quality up to and including three years, after which their deterioration is very gradual.

Interchangeable Sizes. For the benefit of the owners of cars on which tires do not give satisfactory service because of overloads imposed by the motorist, we recommend what we call interchangeable or "over-size" tires. Interchangeable, as we use it, refers to a tire of larger cross section and larger diameter, the bead diameter of which is the same as that of the smaller casing, and can be used on the same rim. Thus a car owner may use a tire of larger carrying capacity without changing the



TOP ROW: 1—MISPLACED FLAP. 2—RUNNING IN CAR TRACKS. 3—NEGLECTED CUTS.
MIDDLE ROW: 4—FAULTY WHEEL ALIGNMENT. 5—MISAPPLICATION.
BOTTOM ROW: 6—SKIDDING. 7—BRUISE. 8—UNDER INFLATION.

rims on his car, and at a slightly added cost for tires should get a marked increased tire mileage.

INTERCHANGEABLE SIZES

Size Tire	Size Rims They Fit	Style Made in
29x3½	28x3	Regular Clincher and Q. D.
31x3½	30x3	Regular Clincher, Q. D. and Str. Bead
33x3½	32x3	Regular Clincher, Q. D. and Str. Bead
35x3½	34x3	Q. D. only
31x3.75	30x3½	Regular Clincher and Q. D.
31x4	30x3½	Regular Clincher, Q. D. and Str. Bead
33x4	32x3½	Regular Clincher, Q. D. and Str. Bead
35x4	34x3½	Regular Clincher, Q. D. and Str. Bead
37x4	36x3½	Regular Clincher, Q. D. and Str. Bead
33x4½	32x4	Regular Clincher, Q. D. and Str. Bead
35x4½	34x4	Regular Clincher, Q. D. and Str. Bead
37x4½	36x4	Regular Clincher, Q. D. and Str. Bead
41x4½	40x4	Regular Clincher, and Str. Bead
43x4½	42x4	Q. D. only
35x5	34x4½	Regular Clincher, Q. D. and Str. Bead
37x5	36x4½	Regular Clincher, Q. D. and Str. Bead
39x5	38x4½	Regular Clincher and Q. D.
41x5	40x4½	Q. D. only
43x5	42x4½	Regular Clincher and Q. D.
37x5½	36x5	Regular Clincher, Q. D. and Str. Bead
37x6	36x5½	Q. D. only
39x6	38x5½	Q. D. only
41x6	40x5½	Q. D. only

NOTE: The above list applies to Clincher and Q. D. tires and to the more popular sizes of Straight Side tires. In some of the less popular sizes we do not have mold equipment for the oversizes in the Straight Bead type.

CHAPTER ELEVEN

Automobile Accessories

INTRODUCTION. Should the consumer heed every advertisement announcing a new and indispensible automobile accessory, he would soon need to substitute a trailer for the tool box. Seriously, however, it is conceded by all motorists that there are certain needful auxiliaries that in a great measure are essential to bring about that comfortable feeling of "Preparedness."

That there are good profits in the sale of accessories is also a conceded fact among dealers generally. As a business proposition it is the quick sale over the counter which really brings the profit, and these items are in this class. Realizing this, we have developed a line of useful and necessary articles for the motorist, which in most cases we have packed in neat cartons which by their attractiveness prompt the dealer and consumer in turn to give them first consideration.

Collapsible Auto Buckets. In the "old days" when men took long trips, with old Dobbin as motive power, the water bucket was part of the necessary paraphernalia. Old felt hats or battered tomato cans were not thought of in those days as substitutes.

Isn't it, then, of more importance in this day of 90 horse power, and longer trips, to go well equipped? Radiators are bound to go dry, and pails are not so easily accessible in the country, even though water may be plentiful. At such a time the autoist needs and wants something that will fill his radiator with the least possible annoyance and delay. The price of it, if reasonable, doesn't matter, for he wants to get there with as little hindrance as possible.

Goodrich Collapsible Auto Buckets are made from strong fabric, well frictioned and coated with rubber, and will last for years. They take up very little room when folded and hold plenty of water when opened —2½ gallons. The spout is equipped with a fine mesh screen, thus making it possible to dip water from a creek and still keep the radiator free from dirt and particles of bark. Quality considered, the Goodrich Collapsible Auto Bucket is worth the money for they will last a life-time.

Blowout Patches. "Accidents will happen in the best regulated families;" likewise, tire troubles will happen with the most careful driving, and everyone knows that running flat not only ruins the casing and tube but tries the driver's patience. Blowout patches in several types are designed to provide a temporary repair for such misfortunes.

The Double Wing is particularly suited for rim cuts and small tread blowouts. It is easily applied and remains secure. The Hook-On type is suitable for all kinds of blowouts. The steel hooks fit securely under the flange of the clincher rim and under the bead of the Straight Bead tire, thus holding the patch securely in place and the inside patch that accompanies this type effectively prevents the tube from pinching. This latter is coated with uncured gum and the heat generated as the tire revolves securely vulcanizes it to the inside of the casing and thus it is held in place.

The Lace-On patch serves the same purpose as the Hook-On and is a type that many prefer. It laces securely over the rim and is provided with an inside patch like the Hook-On which keeps the tube from pinching.

All Goodrich Blowout Patches are made from strong new fabric frictioned with the best of rubber, and when compared with many of the manifestly inferior brands that are marketed, Goodrich Blowout Patches are extremely cheap. They are packed in individual paper cartons which keep them clean and fresh.

Goodrich Self-Vulcanizing Patches. Is there anything that will take the joy out of life and otherwise put a crimp in an afternoon's pleasure quicker than a puncture? Why is it that the autoist's heart sinks within him as he hears the familiar "Tstssssss"? If asked he will explain that nothing makes him quite so peeved as to spend an hour or two over a very unsatisfactory roadside repair. Punctures surely are annoying under any circumstances, but they need not entirely spoil one's pleasure trip.

Many worthless contrivances parade under the pseudonym of Self-Vulcanizing Patches which in reality are nothing but pieces of combination repair gum, doctored up to look like the real article. In even such a small accessory as a patch, we are always striving to maintain our reputation as value givers.

Goodrich Self-Vulcanizing Patches are 2" in diameter made from sheets of the finest vulcanized rubber onto which is superimposed a layer of unvulcanized gum faced with coated muslin. The vulcanized back forms a tough elastic base, while the adhesive portion is kept clean and the patches are kept from sticking together by the muslin facing. When the patch is applied the unvulcanized surface is cured to the tube by the heat generated in the swiftly revolving tire and, it stays cured. It becomes a part of the tube, and remains a part. They are sold by the dozen in neat screw top containers accompanied by instructions for their use.

Goodrich Rubber Mallets. Abuse scarcely describes the treatment given an automobile rim when an ordinary steel hammer, or even a lead mallet, is used upon it. Either of these batter and dent rims and wheels to such an extent that they are not only disfigured but may be rendered unserviceable. Such abuse is entirely inexcusable when one considers that a good, well balanced rubber mallet may be secured which will do effective work without denting the rim or injuring the paint on the wood felloe.

Rubber mallets are not only good for taking down and putting on rims, but have many other uses as well. For instance, they can be used to good advantage in driving bolts thru where a painted surface is presented. They are a necessary tool in every autoist's kit for occasionally anyone is apt to get caught on a road where a tire change may be unavoidable. At such times, "patience ceases to be a virtue" and careless blows are often struck. The result, if an iron hammer is used, is a ruined rim or felloe, while a Goodrich mallet prevents all regrets for it does no damage.

An effective driving blow can be struck with this mallet, for it is carefully compounded with the idea of weight in mind and quality has been maintained thruout. In fact, the two features, quality and effective driving weight, have been combined, producing a mallet of long life and proper balance, which we furnish in seven different sizes, each equipped with a substantial hickory handle. It is also a very necessary item of equipment for the garage or auto repair shop.

Goggles. Constant strain on the eyes from close attention to the road under a glaring sun and the persistence with which small insects and particles of dirt seek the eyes are the two factors responsible for the large demand by the motorist for goggles and he has not been slow in sensing the relief from these annoyances incident to the use of Goodrich ALL RUBBER frame goggles which are comfortable and convenient.

The frames of Goodrich Goggles are made from a soft, pliable, NON-BLOOMING red rubber, are velvety to the touch and comfortable to the wearer. They are made strong, being reinforced at all points where most wear comes. They are well ventilated by small holes around the eye-cups and small ridges which hold them slightly away from the face allowing the free circulation of air. The head straps are of high grade elastic tape equipped with a neat, quickly adjusted buckle that lies flat. Furnished with curved lenses of either clear or amber glass.

Tire Caliper. No one questions the fact that one make of automobile may weigh a great deal less than another, even though the two are of the same general type. Oftentimes these two cars may have exactly the same sized tires. In other cases, the same chassis is used for either a seven passenger touring car, or a roadster. Here again the tires may be the same size. Now the question arises, "Should the same air pressure be used in all these tires?"

When one sits down and thinks it over, the proposition of having an inflexible, set scale of air pressure for all tires of the same size, regardless of the car to which they are attached or the weight which they may carry, is ridiculous. One of the Goodrich experts has made a hobby of this subject for some years and the results of his researches are that fabric pneumatic automobile tires will give satisfactory cushioning qualities and maximum life if, under load they deflect—bulge on the side—nine per cent, i. e., regardless of the weight of the car. This will mean that a 4" tire on one car might need the amount of air specified by the present table, while on another it would require considerably less.

We all appreciate that if pneumatic tires are pumped too tightly they will defeat the very reason for their existence, and really will be no improvement over the solid rubber type. On the other hand, if they are run soft, they constitute a drag upon the engine; they are liable to bruise thru; and they will wear out prematurely because of excessive action in the side walls. To overcome these evils, the tire manufacturers took the only means at first available, which was to establish an arbitrary air volume to be carried in each size tire, and these tables are still generally used. But, as may readily be seen from our opening remarks, this arbitrary table has worked a hardship upon the owners of light cars, or cars that are seldom loaded with many passengers. They, in order to conform to the table of carrying capacities, oftentimes found that when they did so, their pneumatic tires provided a ride comparatively rough, and not all in keeping with what the name of the tire would imply.

It was impossible to ride with the ideal air pressure until the Goodrich Caliper was devised. Now, with the aid of a Caliper, the car owner can get all the cushioning properties that he has a right to expect without endangering tire life thru under-inflation. The Caliper, unerringly gives the proper amount of pressure for any car and has the following advantages over the old type of gauge:

1—It is easier to use—the pressure can be tested without removing the dust and valve caps.

2—It gauges according to the load in the car, and therefore makes certain that the pressure is right.

3—It is equally accurate and good all the time, whereas the average accurate life of an air gauge is only a few weeks.

4—The figures on the scale are deeply engraved, insuring accurate reading and permanency.

5—It costs no more than an air gauge, but will outlast hundreds of them.

Cements. A useful and necessary adjunct to the upkeep of tires for patching tubes, as well as making tread repairs, is the semi-liquified rubber known as "Cement." This accessory is also useful around the home in many other ways, such as repairing rubber boots, water bottles, football bladders, etc. We offer a complete line of this material for general patching purposes which is put up in small containers for individual users, as well as in large cans for commercial purposes. It is generally admitted that Goodrich Cements, whether in tubes or in bulk, excel; and that no better are to be found upon the market.

Three grades of equal quality are furnished, designated by the numbers 1, 3 and 4; the first being a heavy body cement, the second a light and the third a medium.

Plastic. A puttylike substance used to repair tread cuts and prevent the possibility of moisture and grit working under the tread and into the fabric. It sets quickly and becomes practically a part of the tread itself, effectively sealing the cut. While this material is not intended to take the place of a repair stock used on a regular vulcanizing outfit, in case of serious tire troubles; it may be used to good effect for making temporary repairs even where a small section of the rubber is stripped from the tread. Repairs so effected will last long enough for the car to travel many miles without danger of further complications, providing sufficient time be allowed for the Plastic to set before proceeding. For minor mishaps, simple cuts or abrasions of the outer cover, Plastic fulfills all requirements and once well put, will "stay put" for an indefinite period. The reader, however, should bear in mind that this is essentially a home repair material and, that be the injury a large one, the casing should be taken to a reliable repair shop.

Repair Materials in Cartons. Many automobile owners are more or less mechanically inclined, especially those who live in rural communities; and a great many enjoy the work of repairing their own tires by the use of some sort of small portable vulcanizer. For this purpose, we supply our most popular No. 817-G gum, No. 2130 fabric (frictioned both sides and coated both sides), and a Combination Repair Sheet. Inasmuch as these three materials meet all ordinary requirements of the car owner, no other kinds or grades are offered.

No. 817-G gum is put up in 1, ½ and ¼ pound air-tight, screw top cartons, and also in a smaller metal container, holding approximately two ounces. The standard thickness is 3-64 inch. No. 2130 fabric is put up in 1 and ½ pound air-tight cartons. Combination Repair Sheet is put up 1, ½ and ¼ pound screw top cartons, and also in the same type of smaller container as No. 817-G.

Valves. Valves are items of utmost importance; but often prove a source of much annoyance to the auto owner at large, because of ignorance or neglect on the part of the salesman who took his order for tires. It must be remembered that special size valves are required for certain sizes or kinds of rims and tires, and on all orders for tubes, be sure to give the number of the valve wanted and make certain that it is the proper one to use in the casing for which the tube is intended. The following list of valves contains one for every service:—

Schrader No. 777, for 3 inch Regular Clincher Tires.

Schrader No. 967, for 3½ inch tires, either Clincher or Q. D.

Schrader No. 792, this is standard equipment on all tires 4" and larger.

No. 1282 Valve and No. 1329 Stem.—Split or Racing Valve. Must be used for inside tire on dual demountable rims. The valve itself, a small patented device, fits to the tube but the stem unscrews and may be removed from the rim independent of the valve proper. This allows easy application and removal of the tire.

No. 1822.—For all tires used on wire wheels.

Valve Insides are the small springs and plungers that form the inner mechanism, automatically shutting in the air as the tire is pumped up. These inside parts are rather delicate, and on account of the cheapness with which they can be produced, no attempt is ever made to repair them. Therefore, at the first warnings of disorder, they should be taken out and new ones inserted.

The change is a simple operation involving merely the unscrewing of a projecting metal point which is done with the top of valve cap, particularly constructed for just this purpose.

Summary. The selection of accessories is after all a matter of individual desire and taste. The modern automobile comes on the market equipped and ready to go, and should the purchaser have a desire for further convenience he makes his selection from the offerings, according to his own taste, which is naturally in keeping with his daily habits and pursuits. It is then largely a question of suggestions thru advertising, window and counter displays that their utility is suggested and the motorist buys only those which his human desire for luxury supported by his experience justifies.

CHAPTER TWELVE

Automobile Tire Marketing

SELLING. Goodrich automobile tires, both Fabric and Silvertown Cord, are marketed thru branch and depot organizations and are sold in the field by a corps of pneumatic tire representatives. The work of these salesmen is supervised by the branch managers under whose jurisdiction their territories fall, but their activities in the solicitation of automobile tire business are guided, as may be supposed, by the general policies of the corporation. In addition to the special plans each branch manager may have for the promotion of sales in this line, the director of sales at Akron from time to time offers special assistance in form of suggestions, sales helps, campaign outlines, etc.

Diamond automobile tires are marketed thru Diamond control stations, which for convenience are located in the larger mercantile centers of the country such as Chicago; and are sold in the field by a separate corps of sales representatives known as the "Diamond" organization. The activities of these salesmen are under the direct supervision of "Control Managers" under whose jurisdiction the so called Diamond control districts fall. For convenience sake, in as many territories as is possible, the "Diamond" organization is housed in the same building with the Goodrich, and in every instance they work in the closest business harmony and co-ordination.

The work of the Diamond salesmen in the solicitation of automobile tire business is guided by the general policies of the corporation as laid down to govern the

"Diamond" organization and, like Goodrich, in addition to any special plans that the Diamond control managers may have for the promotion of sales, the Akron office from time to time offers special assistance in form of suggestion, sales helps, etc.

It is the aim of the company to carry in stock in all branches and depots a complete assortment of such sizes and types in both Goodrich Fabric and Silvertown Cord tires as are in demand by the trade, and in sufficient quantity to meet all usual requirements. Diamond tires, likewise, in the control warehouses are carried in popular sizes and in quantities to meet the demand. The benefits to the trade in having these branch and control sources of supply located in the more important distributing centers of the country will be apparent, for this arrangement saves delay, and often heavy express charges incidental to hurry shipments from long distances.

Channels of Distribution. We depend for the distribution of Goodrich Automobile Tires primarily upon the retail tire merchants' business. We endeavor never to follow any practice which could be construed by the legitimate tire dealer as an interference with his business, and strive in every way to build up good will with the dealer. This classification includes such concerns as Automobile Manufacturers' Direct Branches, Garages, Car and Truck Agents, Tire Repairmen, Auto Supply Houses and Accessory Stores, or any concern agreeing to stock tires for resale. To all such, except those classified as "small dealers," we extend our P. D. or preferred dealers' prices.

"Small Dealers" are a class composed of those concerns whose volume of business and connection in the automobile tire field is such as not to warrant our quoting them preferred dealers' prices, but who, nevertheless, are bonafide dealers and entitled to something better than the regular list prices. For this class of trade we have a discount from the consumer's list plus the usual deduction permissible for cash payment. Their business, however, is not of such volume as to warrant the Goodrich salesmen soliciting with the same vigor and frequency as they devote to those coming under the category of Preferred Dealers.

Manufacturers of pleasure cars and motor trucks, from whom we in all cases actively solicit business on Goodrich tires for original equipment constitute another main avenue for sales, and naturally the volume and character of their business is such as to entitle them to a separate classification; such concerns receive better than our Preferred Dealers' Prices.

Diamond Brand tires are not sold to manufacturers of automobiles, nor do Diamond salesmen solicit dealers' business. Diamond automobile tires are sold to those who have been approved as regular jobbers.

"Goodrich." From a study of the foregoing chapters the reader has certainly come to a definite conclusion as to what advantages to the consumer lie in the use of Goodrich tires. But, on the other hand, he has probably not come to any conclusion as to what advantage, other than being known as a quality dealer, accrues to the merchant thru stocking and selling our product. For this reason, we deem it wise to devote a few paragraphs to a broad survey of how we assist the dealer in meeting the general tire sales conditions of the country.

Thru our national advertising, thru the prestige of the name "Goodrich," and thru the satisfaction received by the general public, from all of Goodrich rubber goods, we believe that a greater unsolicited demand exists for Goodrich than for any other tire. Benefits to the dealer from this, therefore, will be a quicker and greater stock turn-over with a minimum of effort on his part. He is further assisted in the securing of the consumer's business by the close co-operation of our branches, whose watchword is "Service," and tire dealers all over the country know that when they are competing with Goodrich dealers that they are in reality competing with the Goodrich organization, whose one price policy and record for fair and square dealing has established a standard which all other manufacturers have been forced to recognize.

Goodrich dealers are further assisted in their sales by the close co-operation of a corps of advertising agents whose sole duty is, to, each year prepare and furnish for the dealers use certain "sales helps," such as envelope stuffers, form letters, attractive signs, special bill boards, etc. In addition to this is our Touring Bureau, standing ready at all times to co-operate with the dealer by furnishing him imprinted route cards for distribution among his customers, as well as our Route Books, recognized the country over as not only of invaluable assistance to the motorist but as the greatest piece of tire advertising ever promoted. Truly, a remarkable advantage accrues to the Goodrich dealer.

After all, it is "QUALITY" that counts. You may take advantage of every local and national advertising medium, but it is useless without quality; you may protect your dealers in every way possible, but if the tire lacks quality the customer will not patronize him and, therefore, he will need no protection. You may supply service that excels all speed records, but if quality is not delivered with the goods the dealer's stock shelves will never need replenishing. And finally, if we are not so convinced of the quality present in every tire that we are willing to back it with the very integrity of this reputable organization, the consumer has a right to, and eventually will, go where quality exists and the dealer will follow.

WE HAVE STOOD THIS ACID TEST.

THE MOTORCYCLE TIRE

Introduction

ALTHOUGH the rider of a motorcycle cannot be protected effectively from mud, dirt or weather thus, limiting somewhat its scope of usefulness, evidence is not lacking that this vehicle, as a means of locomotion, has a place in our present day transportation problem, wherein it plays an important part. Its light weight, ease of storage, reasonable upkeep and comparatively low purchase price makes it popular for trips and touring among those who are willing to go without much bulk of baggage.

The motorcycle is used effectively in the control of street traffic in cities and for the policing of highways over which there is a large amount of motor travel; and in the Great World War by reason of its possible speed, maneuvering power and ease of concealment, the motorcycles supreme qualities for army despatch scout work has been amply demonstrated.

The time will probably never come when the two wheel motor vehicle will succeed in competition with the cheap automobile, but there is also reason to believe that in certain lines of work the motorcycle cannot be supplanted by the four wheel vehicle, however, cheap in price or reasonable in operation. Many public utilities corporations such as Gas, Electric and Telephone Companies find motorcycles extremely useful in emergency repair work or for trouble service. They are in use by the government in its special delivery postal service, and in numerous other ways this vehicle may become invaluable to the public.

We will herein relate a portion of the history of the invention and development of the motorcycle, fragments of the detail of the evolution of the motorcycle tire, and in as brief a manner as possible describe the present day processes of manufacture. Such a story as this, however, must be synoptic in character, relating only enough of historical data and describing enough of the manufacturing practices to furnish the reader with a general comprehensive view of this branch of the rubber industry from its inception to now.

CHAPTER THIRTEEN

History of the Motorcycle and Tire

ORIGIN AND EARLY INVENTION. Although many experiments and inventions bearing directly on the self-propelled vehicle idea had been made prior to the time when this tale begins, some of which were more or less successful, the first real motorcycle was invented by a German (named Daimler), in 1886, and antedates the Dunlop pneumatic tire about three years. Unlike those of his predecessors who had been working along the lines already laid down by steam engineers, Daimler's invention was based on an internal combustion engine, a principle at that time almost entirely new. However, the locomotion idea paramount in the minds of men was then the thought of a horseless carriage; and Daimler's invention and patents were purchased from him and applied to the construction of a four wheel power vehicle. Thus, the motorcycle was lost in the shuffle of automobile experimenting and we do not again hear of a two wheeled power vehicle until the French machines were introduced to us in 1898.

The first American motorcycle was manufactured by the Thomas Motor Co., of Buffalo, New York, in 1900. By attaching a single cylinder gasoline engine to the transverse bar of an ordinary bicycle and running a flat belt to a concentric pulley on the rear wheel, they succeeded in their endeavor to construct a power bicycle which would at least attain a fair rate of speed when operated under favorable road conditions. In 1901 the Hendee Manufacturing Company of Springfield, Mass., (makers of the Indian Motorcycle) brought out a machine with the engine suspended in the lower part of a specially designed heavy frame. Others followed this lead and soon there were several machines in the field, but this first Hendee machine is-so-far as American endeavor is concerned marks the real beginning of motorcycle development.

Evolution. Several manufacturers have participated in the development of the motorcycle from this wheezy and uncertain power bicycle to its present high standard of efficiency and wide scope of usefulness, from its real beginning in 1901 with the advent of the first "Indian." Space, however, will not permit us to enumerate the trials, failures and successes of each and therefore we leave this tale for the motor vehicle historian to tell, confining ourselves to the story of the main steps in the advance of the machine itself.

In the years 1902, 1903, and 1904 important improvements were made, such as Grip Control, Stronger Frames, more Comfortable Saddles, etc. In 1905 the first twin cylinder engine made its appearance, and in 1908 magneto ignition made power more constant. Thus, these first improvements increased the speed and made more dependable the two-wheeled power vehicle, and each year since has witnessed some slight change for the better in its construction and design. This development had, however, up to 1908 been slow on account of the lack of capital and credit among the exponents of this new means of transportation. But the next year (1909) saw the motorcycle industry almost revolutionized.

The Hendee Manufacturing Company led in this radical movement with a new machine entirely different from any previous model. Direct Transmission, Band Brakes, and a new and Heavy Frame Construction were a few of the many changes that took place. Previous to this the motorcycle, like the bicycle, was constructed with its wheels bolted rigidly to the forks, and the rider, therefore, was dependant upon the cushioning properties of the tire, supplemented in a few cases by spring saddles, for comfort in riding. But, during the interim from 1909 to 1915, various kinds of springs were invented and adopted which further popularized this two wheel power vehicle as a means of transport. Kick starters, electric lights, and in short most of the attachments found on the automobile were also almost directly thereafter, adopted and thus, rapid travel over country roads became more comfortable, safe and convenient.

During this period of development, side cars also came into use for passenger and bundle delivery service and as a consequence the motorcycle became extremely popular not only as a pleasure vehicle for young men, but as a utility vehicle for public service corporations, stores and factories. Its cheapness and dependability as a means of transportation has recommended it to military authorities and today, no great army is without its motorcycle division. But here let us pause and determine, if possible what single factor has had the greatest influences in this development. Can we claim that motor improvement in speed and dependability has brought this to pass or that the strengthening of the frame and the adoption of springs, for instance have been responsible for the rapid rise of motor-cycle popularity? We think not—for with all of these, like the automobile, this wonderful machine has only been made possible through the development of the pneumatic tire. Were it not for this highly efficient, modern shock absorber and power transmitter this vehicle would still be a slow, cumbersome proposition if not an utter impossibility.

Motorcycle Tire Evolution. Being as it was, an evolution of the bicycle, the motorcycle, naturally, in the beginning consisted of comparatively light construction. In truth, most of the manufacturers in the early days used common bicycle materials including tires, as exemplified by the fact that the first American machine (Thomas) was equipped with Goodrich 1⅝" "999 Tandem" bicycle tires. Later on, as machines were made heavier and twin cylinder engines developed, it was found that heavier and stronger tires were necessary to withstand the stress and strain of the added load and increased speed. So, we have following, naturally, the adoption of the 2" in 1903, the 2¼" in 1904 and the gradual development of the tire to its present heavy duty standards.

With the principle of proper tire balance always in mind (correct proportion of tire fabric, tread compound, etc., to the size of the tire) the B. F. Goodrich Company constructed in 1909, a two-ply tire with heavy fabric, heavy tread and sidewalls, the idea being to have resilience and easy riding, plus more strength, and the results were generally satisfactory. The power and range of the motorcycle had, however, further increased to such an extent by 1911, that it had resulted in the demand for a still more durable tire, and it was found necessary by the use of superior grades of fabric and compounds to construct a three-ply tire which would retain a great measure of the resiliency of the old two-ply tire and at the same time be much stronger and more lasting. Since motorcycles were constantly being adopted for commercial uses, and the service requirements of the tire became greater, users commenced to equip their machines with 3″ automobile tires. But, these on account of their shape and the construction of their beads were not suited to motorcycle service, and consequently we found it advisable to adopt a 3″ motorcycle tire made identically like an automobile tire, except in shape and bead construction. These tires were introduced in 1912, and are now generally used on all of the heavier machines.

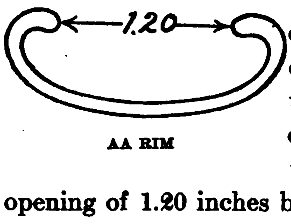
CHAPTER FOURTEEN

Motorcycle Rims

RIM DEVELOPMENT. Prior to the time when the first twin cylinder motorcycle engine was produced (in 1905), crescent and the clincher types of bicycle rims were used on this type of power vehicle. In this year, however, a standard width steel *motorcycle* rim was universally adopted, by the manufacturers at a get-together meeting, to accommodate the heavier tire found necessary for safety's sake and this rim remained in general use until 1912.

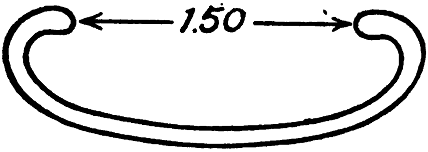
The O. T. Rim. This first standard steel clincher rim which is now known as the O. T. (Old Type) was made with an opening of 1.35 inches between the clinches, and two wheel sizes were originally adopted, 26 and 28 inch to accommodate 2¼, 2½, 2¾ and 3 inch tires. Since, however, twenty-six inch wheels were used only by a few manufacturers and by them only for a short time there are very few in use today, and consequently 26" tires to fit the O. T. rim will be found only on the machines of ancient model. Nothing more need be said about this size since their use is gradually decreasing, except that we are still equipped to make tires to fit them.

As time went on and the demand for larger tires manifested itself, the insufficient clearance between the tire and the forks as well as mudguards, became a serious proposition. Accordingly, the Society of Pneumatic Tire Manufacturers suggested that new rim standards be worked out and future motorcycles built to conform to whatever new dimensions might be adopted. To secure rims which would have strength and still not be and appear unwieldy the engineers in response to this suggestion designed and recommended three rim widths, suggesting that the distance between the clinches of each be just sixty per cent. of the diameter of the normal tire size. These suggestions were accepted by the motorcycle and tire manufacturers in conference and the new rims now known as AA, BB, and CC came into use on 1913 models, which commenced to appear in quantities late in 1912. All three are, of course, of the one piece continuous clincher design, and are made to accommodate none but tires with soft or extensible beads.



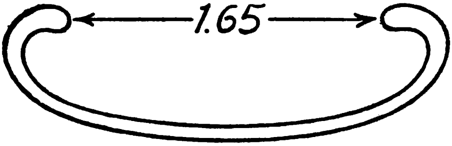
AA RIM

The AA Rim, adopted as one of these three new standard designs, was made with the intention of using it exclusively on racing machines and it was therefore constructed with an opening of 1.20 inches between the clinches to accommodate 28 x 1¾" and 28 x 2" tires only. There was, however, such a limited demand for this rim that makers of light weight motorcycles and board track racing machines preferred to continue using the OT 2" racing rim and the AA has accordingly never been manufactured. Naturally the Goodrich Company has never been equipped for making tires to fit this unused rim.



BB RIM

The BB Rim was designed with an opening of 1.30 inches between the clinches and made in one diameter to accommodate 28 x 2¼″, 28 x 2½″ and 29 x 2¾″ tires, which were used as equipment on machines built directly after the adoption of the new rim standards in 1912. Owing, however, to the rapidly growing demand for machines equipped with tires of a still larger cross sectional diameter, sizes to fit BB rims never became extremely popular. They have today (1918) nearly fallen into disuse and it will doubtless be but a question of a short time until they have entirely disappeared, except on machines of the lightweight class which are using 26″ wheels.



CC RIM

The CC Rim was designed with an opening of 1.65 inches between the clinches and in one diameter to accommodate 28 x 2¾″, 28 x 3″ and 29 x 3½″ tires. As previously mentioned the general tendency has been toward a heavy and speedier motorcycle which necessitated the adoption of heavier and larger tires, and this reason alone is cited by some as responsible for the popularity of the CC rim. At any rate it is a fact that the CC is the one in general use on all standard types of machines today. Nearly 95% of all motorcycles are now equipped with 3″ tires and consequently the CC rim has become the real standard motorcycle rim adopted by all American motorcycle makers.

Interchangeability of M C Rims. Tires made to fit BB rims are not interchangeable to CC or vice versa, and neither can O. T. (Old Type) tires be successfully used on new type rims, as their beads are very much smaller and will not sufficiently fill the clinch openings on the new type rim. Likewise, neither will tires made for the new type rims work successfully on O. T. rims. These simple facts should at all times be borne in mind by those coming in contact with motorcycle tire sales. Many an awkward experience and perhaps useless expenditure of time and money can be averted by careful application of this knowledge.

CHAPTER FIFTEEN

Motorcycle Tire Construction

HOW MOTORCYCLE CASINGS ARE BUILT. Motorcycle tires, in the Goodrich factory, are constructed with the same equipment and in almost identically the same manner as are automobile tires. The same rigid inspection of materials prevails, the same skill is used and the same careful methods of construction are followed. Only the highest quality of fabric goes into the carcass, an automobile tire duck being employed for all tires 3 inches and above and a slightly lighter weight, but excellent quality for those of lesser diameter. Compounded stocks of the highest quality and resilience are used, and the tread particularly is of an extremely tough consistency which resists to the last degree the abrasion of the road.

Since the machinery and methods used in building our motorcycle tires are almost identical with those used in the manufacture of automobile tires and since the descriptions of these processes are so carefully and clearly made known in that part of this volume dealing with the Pneumatic Automobile Tire to repeat them here would be but a waste of time and space. We therefore omit this detail from this chapter passing on to those things which are peculiar to the motorcycle tire.

Inner Tubes. We are manufacturing inner tubes for motorcycles in two styles, i. e., Endless and Butt End and in two colors, grey and brown. All are constructed from the same high quality stock as are our automobile tubes and except in the case of the Butt

End type are made precisely in the same way. Because, also motorcycle tubes are constructed in the same manner as automobile tubes, we will not here again describe the process, but will refer the reader to chapter nine of this text where a detailed description of this process will be found. (See table of contents under tube construction, "Automobile Tire Manufacturing Processes.")

The construction of Butt End motorcycle tubes proceeds in the same manner as the Endless Automobile tube up to the point of splicing but from here on it differs in that the ends rather than being joined and spliced are left free being closed and afterward reinforced with strong canvas. To prevent this tube from wrinkling or slipping out of its place in the casing, the ends are equipped with a convenient and secure button fastener and in addition there is a metal eyelet at one end which slips over the valve stem located at the other. This arrangement which allows the tube to be taken from the casing without removing the wheel from the frame because of the difficulties experienced by the average cyclist in removing rear wheels for the purpose of repairing inner tubes, has made the Butt End type extremely popular in motorcycle circles.

Inflation Pressure. The jar and vibration attending the use of the motorcycle over rough streets and roads has created the very natural tendency on the part of the average rider to run his tires as soft as possible, since having them so will give more comfort in riding, and generally, he is loath to admit this fact when defects develop which point to prevalent under inflation, such as rim-cutting, breaking of the fabric at the side of the tread and chafing of the tube. We are frequently requested to specify an inflation pressure which can be calculated to eliminate this difficulty. We do not, however, advocate an inflexible fixed air pressure or inflation schedule for motorcycle tires since the weight of the equipment and the distribution of the same differs so greatly on the various machines, using the same size tires as standard equipment. The safest rule to follow is to be assured that there is no appreciable deflection of either front or rear tires when under load. Seldom, however, do riders of the motorcycle over-inflate their tires but on the contrary under inflation is often the rule. This condition which constitutes such a serious abuse of the tire and of the good faith of its manufacturers should be preached against morning, night, and noon and no opportunity neglected to urge upon the consuming public the proper method of inflating.

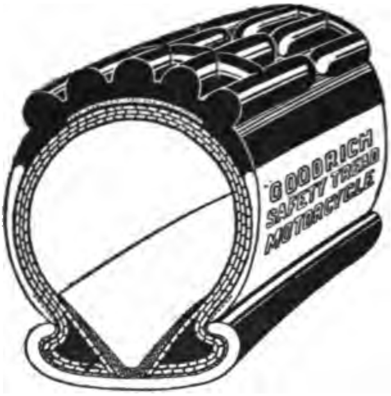
Guarantee. Motorcycles are often guaranteed by their respective manufacturers for one year from date of purchase, which guarantees almost invariably specifically provides that all parts and equipment not manufactured by them are guaranteed by the makers thereof, with whom all matters of defects or adjustments should be taken up direct. Although, motorcycle makers do not intend to mislead their purchasers many users get the idea, from the wording of this guarantee, that motorcycle tires are guaranteed for ONE YEAR.

It will be recognized at once that there are so many service conditions beyond our control, that such an arrangement is entirely out of the question. One rider will equip his machine with tires of maximum size and take the best care of them, deriving two seasons service or even more. Another rider will use the smallest tires possible, ride them deflated a good share of the time, overload them, and take no care of them whatsoever. Should the tire go bad early under this ill treatment, this rider will often denounce tires in general, and attack the policy and good faith of the manufacturers if they refuse to make good the supposed one year guarantee.

The B. F. Goodrich Rubber Company guarantees its motorcycle tires to be free from defect in material and workmanship, but not to give any definite mileage. In case defects in material or manufacture develop in such, they will be adjusted on a 3500 mile basis, but we will not consider for adjustment any motorcycle tire that has been used on a rim other than the type for which it was intended. It should not be difficult to determine the type of tire necessary in every case, as each is branded on the side "To fit BB rim" or "To fit CC rim," as the case may be.

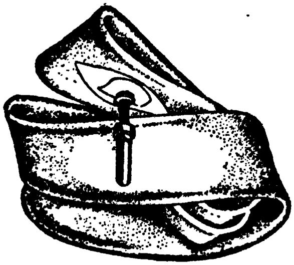
CHAPTER SIXTEEN

Motorcycle Tire Brands

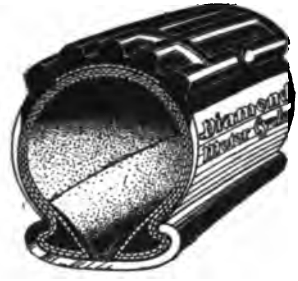


Goodrich Brand. A distinctive combination of black tread white sidewall stock, like that used in the construction of Goodrich Auto-cases, has been selected for this tire which adds to its attractiveness in addition to indentifying it at once as a member of Goodrich family. It is made in the regulation five bar Safety Tread design to fit O. T. and CC rims in such sizes as are in use on all popular machines. Since the "Safety" pattern is by this time so well known to our readers we will not here describe the merits of this non-skid tread except to mention that after having experimented with several we are convinced that for motorcycle use, the five bar Safety offers the cyclist greater freedom from skidding than is possible with other anti-skid treads, unless they be of similar pattern.

Furthermore, the employment of the correct proportion of strong frictioned fabric, tough tread stock and other components, gives us a perfectly balanced, extremely resilient and wear-resisting tire. As a result the motorcycle equipped with "Goodrich Safety" treads will be easy riding, require a minimum of power and have little tire trouble. More plies of fabric would not improve its wearing qualities but on the contrary, an added number would stiffen the carcass, thus increasing the friction as the walls worked back and forth under action. It is a well known fact that such internal friction generates heat to a degree proportionate to the thickness of the walls and the thicker carcass, the higher the heat, in consequence of which the more rapid the deterioration of the fabric and the final destruction of the tire. Likewise, heavier treads, and disproportionately large non-skid patterns do not improve a motorcycle tire, but on the contrary tend toward fabric bruising and tread separation. Furthermore by actual test it has been determined that extremely heavy treads wear out more rapidly than the exceeding tough, moderately heavy tread used on the "Goodrich Safety."



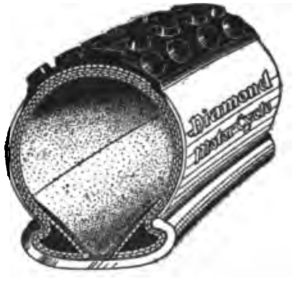
Goodrich Tubes. Inner tubes for motorcycle use made under the Goodrich brand and furnished in either Endless or Butt End types, both in either grey or brown stock. Our grey tubes are made only from the best selected grade of pure rubber .plus only the sulphur necessary for vulcanizing and for this reason represent the limit in elasticity and durability. Those looking for value in tubes will find the Goodrich grey all one could possibly expec tor wish for in such an article. Our brown motorcycle tube which is slightly compounded will deliver service far in excess of most colored tubes for it possesses the toughness of leather, yet the elasticity of a fine rubber band and is decidedly different and distinctive from most colored articles of this kind.



RED SIDE WALL

Diamond Brands. Diamond motorcycle tires are made in two designs, viz., Squeegee and Studded Treads. The former is furnished in the five bar style to fit OT, BB, and CC rims in the such sizes as are in demand by users of the popular makes of motorcycles.

Since the Squeegee design will be so well known to our readers, we will not here take the time to describe the merit of this tread, but will merely mention that this motorcycle tire differs from the Goodrich Safety only in that the center bars do not break but run circumferencially around the crown of the tread, thus forming what is known as a "More Mileage Strip." This is a tire that has long been the favorite with the motorcycle rider.

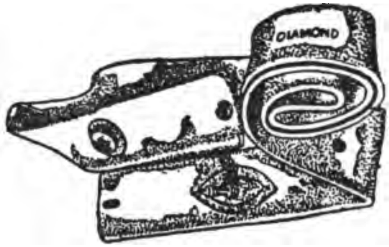


RED SIDE WALL

Diamond Studded Tread motorcycle tires are made in several sizes to fit OT rims, and in addition are made to fit New Type rims in a few of the popular sizes. This tread which was adopted by us in 1910 for use on motorcycle casings consists of four parallel rows of buttons in addition to a strip, known as "The More Mileage Strip," 5-16″ wide molded circumferencially around the crown of the tread, binding together the two center rows of rubber buttons or studs and thus forming traction angles on either side, where each stud joins to it.

This tread pattern, however, has today very little demand by motorcycle riders so that its sale is practically confined to tire sizes to fit O. T. rims for which we do not have Safety or Squeegee mold equipment. It will be found useful as an offering to riders of ancient model machines equipped with O. T. or BB rims.

Diamond Tubes. Motorcycle tubes are manufactured under the Diamond brand in either the Endless or Butt End types but in grey stock only. These, also, like the Goodrich grey are made from pure rubber plus only the sulphur necessary for vulcanization and accordingly represent the limit in elasticity and durability. Those looking for value in tubes will also find Diamond grey all one could possibly expect or wish for in such an article.



CHAPTER SEVENTEEN

Motorcycle Tire Marketing

DISTRIBUTION AND SELLING. Goodrich motorcycle tires are marketed thru our branch and depot organizations, and are sold in the field by the regular corps of pneumatic tire representatives. These salesmen work under the direct supervision of the branch manager under whose jurisdiction their territories fall, and their work in the solicitation of motorcycle tire business is under his direction; guided, of course, by the set policies of the company governing the sale of this product.

It is our aim to carry in stock, at all branches and depots, a complete assortment of such sizes as are in demand by the trade and in quantities sufficient to meet all reasonable requirements.

Channels of Distribution. In marketing Goodrich motorcycle tires, we have four channels of distribution:—(a) Motorcycle Manufacturers, (b) Jobbing Houses, (c) Small Dealers and (d) Large or Three Star Dealers.

The Manufacturer. When we come to a full consideration of the motorcycle tire business and its peculiarities we see at once that unusual conditions of merchandising prevail in this field. When a tire manufacturer is willing to sell his product to the motorcycle manufacturer at a price below the cost of production (as some of them have done) in order to secure the prestige that obtains with original equipment, it is obviously necessary for that tire manufacturer to make up this loss on the volume of business he secures from the jobber, dealer and consumer. Although, we do not underestimate the importance and desirability of securing as much of this original equipment business as possible and will actively solicit for it at all times, we are not so extremely anxious to have our motorcycle tires appear as original equipment, that we are willing to sacrifice profits for the sake of securing manufacturers contracts.

The Jobber. Large jobbing houses are not as a rule enthusiastically interested in the distribution of motorcycle tires although there are some few large sporting goods houses who do list and handle them. Usually, however, these concerns will not be interested unless they can secure a price fairly close to the one received by the manufacturer of motorcycles. We, however, do not have a special proposition on Goodrich brand tires to offer such concerns but classify them as regular jobbers, and this includes all concerns doing a wholesale business in hardware, motorcycles, bicycle, and automobile accessories, supplies and tires whose wholesale business amounts to 75% of their total sales, and to all distributors or dealers in motorcycles who sell fifty or more machines in one year. To these are extended our minimum or "Three Star" price.

The Dealer. From what has been related in the foregoing paragraphs, there will doubtless be none who have not by this time realized that the best channel for the distribution of motorcycle tires lies, after all, thru the man who comes in daily contact with the ultimate consumer. Although, to all appearances this dealer may be and often is a small dealer, perhaps a man with a small repair shop or a limited or small town agency, he is nevertheless, on intimate terms with the riders in his vicinity and therefore, able to suggest what tire they shall buy. It will no doubt, however, be apparent to our readers that all such dealers do not fall into the same classification and that there will be large and small ones from the standpoint of volume in sales and this condition naturally determines the price to which they are entitled.

Those who will agree to stock and push motorcycle tires will be given our minimum or Three Star dealers price, whereas those who are merely passively engaged in the sale will be classified as and given a small dealer's price. This plan virtually amounts to a Large Dealer Sales Policy, since this class of trade will be safeguarded in the sale of Goodrich Motorcycle tires against encroachment by the jobber, no better price than they receive being given to anyone not a manufacturer of motorcycles and to them only for original equipment.

Diamond Distribution. Diamond motorcycle tires are marketed by the Diamond Organization thru one channel only, i. e., to those concerns on the Diamond Control Reserve list. The Diamond organization will not solicit manufacturers business nor do they sell to dealers not on their reserve list. Goodrich salesmen, on the other hand, may if they have calls for them, sell Diamond motorcycle tires to manufacturers, jobbers and in fact all classes of trade, though no credit accrues to the Goodrich organization from such sales.

Review Questions—Bicycle Tires

CHAPTER ONE

1—As far as is known; when, by whom and where was the bicycle invented?

2—As a means of transportation was the first bicycle a success?

3—What discovery made in connection with the bicycle has since been recognized as one of the greatest in the history of transportation?

4—How did this discovery affect the development of the bicycle?

5—What three types of tires for bicycles eventually came into general use?

6—By whom was each invented?

7—What is a Morgan & Wright tire?

8—What part did The B. F. Goodrich Co. play in the early history of the pneumatic bicycle tire?

9—What is the Palmer bicycle tire?

10—What type of bicycle tire has predominated in the U. S.?

CHAPTER TWO

1—What three types of bicycle rims are in use?

2—Which one is most popular in the U. S.?

CHAPTER THREE

1—What three fabrics are generally employed in the construction of the bicycle tire?

2—How is the Palmer fabric made?

3—What significance has color in the manufacture of bicycle tires?

4—What is a veneer tread?

5—Is this plan of construction practical?

6—What are the principle methods used in the construction of the single tube bicycle tire?

7—Which method is employed by the Goodrich Co. and why?

8—How is the Palmer bicycle tire constructed?

9—Why do we use the method we do in making the Palmer?

10—When and by whom was the Palmer tire first made in the U. S.?

11—What is the result of this plan of construction?

12—How is the clincher bicycle tire built?

13—What is a Road Weight tire?

14—What is a Puncture Proof tire?

15—What is a Tandem Weight tire?

16—What does motorcycle fabric mean in bicycle tire construction?

17—How are single tube tires cured?

18—How are clincher bicycle tires cured?

19—Are Palmer bicycle tires cured the same way as other single tube bicycle tires?

20—How are bicycle inner tubes constructed?

21—What two general classifications do they divide into?

22—What method constitutes the acme of perfection in the construction of bicycle inner tubes?

23—Why are some tread designs impractical?

24—What kind of a valve is used in an ordinary single tube tire?

25—Is the same kind used in the Palmer?

26—What kind of a valve is used in an inner tube for bicycle tires?

27—Under what conditions can the use of anti-leak preparations be recommended?

CHAPTER FOUR

1—Why do we see such a multitude of differently branded bicycle tires in use?

2—What is the present tendency in the bicycle tire field?

3—How are Goodrich Brand bicycle tires marketed?

4—What feature enables us to make tires of many brands without a full complement of molds for each brand?

CHAPTER FIVE

1—What are the Goodrich channels of trade?

2—How are Diamond brand bicycle tires marketed?

3—How are special brand bicycle tires marketed?

4—Why does the manufacture of bicycles offer such a limited market for trade marked tires?

5—Would you continue to persist in soliciting manufacturers business?

6—What are the principal characteristics of the Goodrich line of trade marked brands?

Review Questions—Automobile Tires

CHAPTER SEVEN

1—When were automobile tires first manufactured?

2—What type of pneumatic tire was first used on automobiles and why?

3—What general type soon became the standard for automobile use?

CHAPTER EIGHT

1—What brought about the Q. D. and Straight Bead types?

2—What is the difference in the three types of tires? Are they interchangeable?

3—What means are provided for preventing a regular clincher tire from slipping on the rim?

CHAPTER NINE

1—Why is fabric placed in the tire on the bias?

2—Why is the machine-made tire better than the handmade?

3—How are the rubber sidewalls and tread affixed to the tire?

4—What do we mean by curing or vulcanizing, and how does this improve or change the raw rubber?

5—What evils would result from over or under curing?

6—What precautions are taken during tire manufacture to see that none but perfect tires are offered?

7—Why are non-skid treads used on tires?

8—Why is our Safety the "Logical" design?

9—Describe the workings of our Safety non-skid tread?

10—What added value does the non-skid feature give to a tire?

11—What are the eight essential parts of a casing?

12—Of what use is the breaker strip?

13—How many plies of fabric are ordinarily used in our construction? Why not more or less?

14—Why do we use a flap in the Q. D. and Straight Bead casings?

15—What is a tire bead?

16—What is the characteristic of the bead in a Regular Clincher tire, and why?

17—On what rims are Regular Clincher tires used? Can they be used on any others?

18—What is the Straight Bead type of tire?

19—Are our Regular Clincher and Q. D. Clincher tires interchangeable? Would you recommend that the unit molded type of tire is better than the single or double cure wrapped tread?

21—Why isn't a tire built of a greater number of plies of fabric than is used in our construction stronger and likely to give greater service?

22—Why is it that a tire having an unusually thick tread will not give as much service as a tough tread of moderate thickness like the ones we construct?

23—How are Silvertown Cord tires made?

24—What characteristic in the construction of Silvertown tires makes them the most successful tire of the kind?

25—What are the advantages of Cord tires on Gasoline cars?

26—What are the advantages of Cord tires on Electric cars?

27—How is an inner tube made?

28—How does our method of inner tube manufacture differ from that of some other makers?

29—What does our method of manufacture provide against?

30—How many types of automobile tires are in common use?

CHAPTER TEN

1—What is the Goodrich guarantee on tires?

2—What are the most common violations of the guarantee?

3—Why and how is under-inflation likely to injure a tire?

4—What is a handy rule for a motorist to follow covering the inflation of his tires?

5—What effect has heat on the air pressure in tires?

6—How does overloading affect a tire?

7—What means do we provide the car owner for equipping his car with larger sizes, if necessary?

8—What effect does a bruise, usually caused by a sharp blow, have on a tire?

9—If the wheels on a car are not in alignment, what is the effect on the tire?

10—How does skidding injure tires?

11—What effect has constant running in ruts or against curbs have on a tire?

12—How should small cuts in treads be treated and why?

13—Do we recommend the use of inside protectors in automobile casings under any circumstances?

14—Is the use of chains liable to result in tire injury?

15—What causes rim-cutting?

16—What is the effect of heat, light and oil on tires?

17—Do we recommend the use of gas for tire inflation? Why?
18—Why is a tire filler detrimental to the life of a tire?
19—How does the use of a tire filler affect our guarantee?
20—How would you advise that an autoist care for his tires.
21—What is the affect of age on tires?

CHAPTER ELEVEN

1—What would you recommend to a man as a repair cure for slight tread cuts?
2—What have we in our line in the way for an easy and convenient patch for punctures?
3—What valve would ordinarily be used on a 4-inch Q. D. tire?
4—Why do we recommend the Caliper rather than the air gauge?
5—What kind of cold or acid cure cement would ordinarily be purchased for general use?
6—What do we offer in the way of a small lot of unvulcanized gum to the owner who does his own repairing or the repair man who wishes small lots?

Review Questions—Motorcycle Tires

CHAPTER THIRTEEN

1—When did the motorcycle originate?

2—When did its development start?

3—Who made the first American machine?

4—To whom can we give credit for the first real American motorcycle?

5—Why were improvements at first slow?

6—What improvement started the motorcycle on a more rapid rise to popularity?

7—What tires were first used on motorcycles?

8—What other type of tire has developed?

CHAPTER FOURTEEN

1—What rims were first used as motorcycle equipment?

2—When was the first special heavy motorcycle rim developed?

3—Why did this rim prove unsuitable?

4—What are the AA, BB, and CC rims? Has the first mentioned ever been used? Which one is most popular today?

5—What information is necessary before making a motorcycle tire sale?

6—Will an old type rim accommodate a tire made to fit a BB rim?

CHAPTER FIFTEEN

1—How are present day motorcycle casings constructed?

2—Wherein does motorcycle inner tube construction differ from an automobile inner tube?

3—What can be said in favor of the Butt-End tube?

4—What rule should be used regarding inflation of motorcycle casings?

5—What constitutes the guarantee on motorcycle tires?

CHAPTER SIXTEEN

1—What advantages has the Goodrich Safety motorcycle casing?

2—Why do we still manufacture the studded tread under the Diamond brand?

CHAPTER SEVENTEEN

1—What in effect is our motorcycle selling policy for Goodrich?

2—For Diamond?

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